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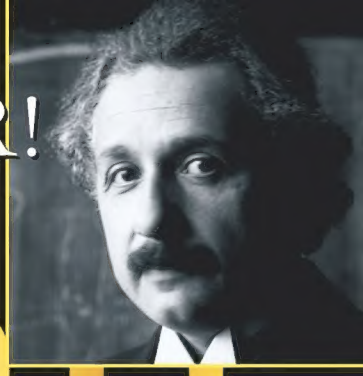

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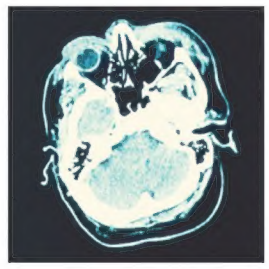

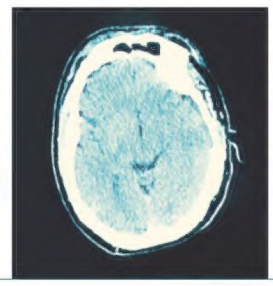

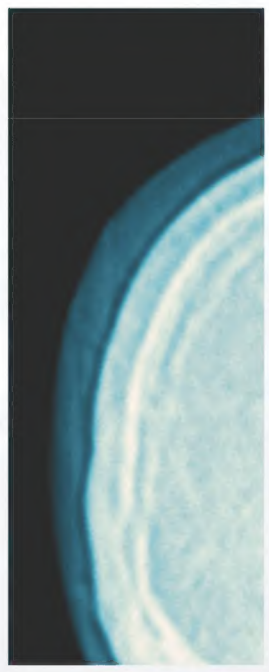

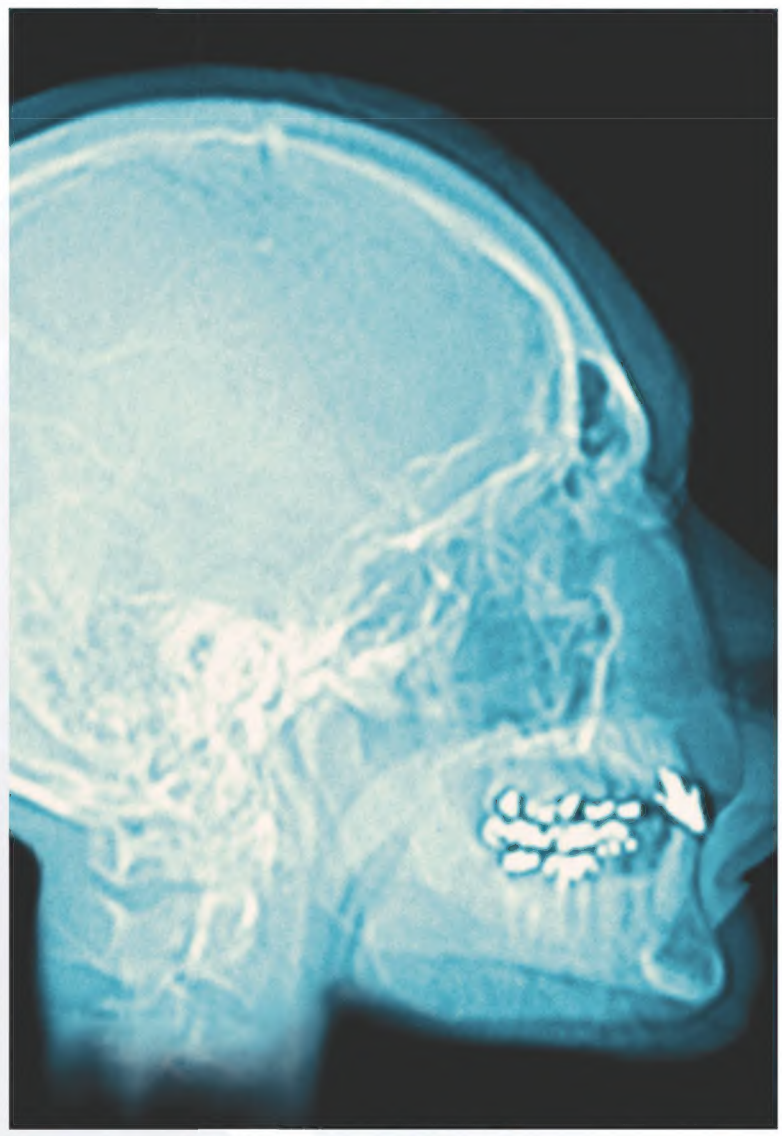

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JUNE 2005 VOLUME 36, NUMBER 3

"Chris Shaver remembers standing on the rim of the Grand Canyon with her then 6-year-old daughter in 1990. The girl looked at the barely visible cliffs and said, 'Mom, I don't know how to tell you this, because I know how hard you are working, but you're not doing a very good job.'"

"HAZY DAYS IN OUR PARKS," PAGE 54

THIS PAGE: Even after nearby power plants slashed emissions, haze remains at Grand Canyon National Park (the view from the North Rim), indicating that most of the pollution comes from far away.

COVER: More than 5,000 artifacts were unearthed from Tutankhamun's tomb, including this miniature coffin, fashioned of gold and inlaid with semiprecious stones. Cover image courtesy of Andreas F. Voegelin/ Antikenmuseum Basel und Sammlung Ludwig/ Supreme Council of Antiquities, Cairo

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The air in many of our national parks is as bad as some of our most polluted cities. Cleaning it up may take a fresh vision

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Until cooler heads prevailed, a peripatetic pig on a small Pacific Northwest island nearly touched off a third war between the United States and Great Britain in 1859

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Gregory Colbert's dreamlike photographs of humans posed with cheetahs, eagles and elephants have enchanted the public even as they repelled some critics

BY CATHLEEN McGUIGAN / PHOTOGRAPHS BY GREGORY COLBERT

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One of nature's eeriest and deadliest creatures, the box jellyfish, lurks in idyllic tropical waters around the world

BY PAUL RAFFAELE / PHOTOGRAPHS BY PAUL SUTHERLAND

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Prospering Mexican immigrants—illegal and not—are helping transform life back home. They are also overturning some deeply held beliefs about them in the United States

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The first Tutankhamun exhibition to visit the United States in more than a quarter-century sheds new light on the life and death of the mysterious boy king and his young wife

BY RICHARD COVINGTON

108 THE YEAR OF ALBERT EINSTEIN

One hundred years ago, a junior clerk in a Swiss patent office turned physics upside down with four seminal papers that made his name synonymous with "genius." But he would claim never to understand the public's enduring fascination with him and his work **BY RICHARD PANEK**

TOM BEAN

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With its spindly legs and long, tapered snout, the comically conformed elephant-shrew might more aptly be called a dwarf antelope-anteater

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"Einstein today is more myth than man, and the essence of that myth is that the workings of his mind are beyond the reach not only of most mortals but of most physicists."

—"THE YEAR OF ALBERT EINSTEIN," PAGE 108

THIS PAGE: According to Einstein's calculations, time itself wasn't an immutable part of the universe.

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What is it about dogs that so endears them to us? Their loyalty? Their uncanny perception? Their endless capacity for energy, enthusiasm and love? Whatever it is, let's raise our water bowls to them.

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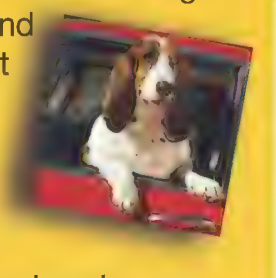

■ **Nipper** is the original canine audiophile, immortalized as the logo for RCA when caught listening to "His Master's Voice."

■ The indomitable Saint Bernard **Balto** crossed 650 miles of snow and ice to deliver diphtheria serum to epidemic-ridden Nome, Alaska.

■ FDR's dog **Fala** was an honorary Army private who got his position by being among the first to "donate" a dollar to the WWII war effort.

■ During WWI, the bull terrier **Stubby** became a hero when he captured a German spy. President Wilson invited him to the White House and shook his paw.

■ Rescue dogs **Sirius, Apollo, Riva** and **Salty** are four unsung heroes of 9/11, who worked to save lives alongside all the other policemen and fire fighters.

Finally, here's to that special dog that you know, who holds a special place in your heart.

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EDITOR'S NOTE

SEEING A GHOST

A WOODPECKER FEARED EXTINCT REAPPEARS IN ARKANSAS **BY LAURA HELMUTH**

As we were putting the finishing touches on this issue of Smithsonian, scientists announced they had seen an almost mythical creature long thought extinct—an ivory-billed woodpecker. A team led by Cornell University ornithologists tracked a lone male found in an Arkansas national wildlife refuge for 14 months while the Nature Conservancy bought up adjacent lands. The scientists spotted the ivory-billed bird 15 times and even filmed it—the first confirmed sightings in the United States in 60 years!

Once, the bird's plaintive *pait pait pait* call echoed across swampy forests throughout the Southeast. But the birds began to dwindle in the late 1800s as loggers cut the ancient trees where the woodpeckers nested. The species was one of the first known to face extinction because of human damage to its habitat. Birdwatchers call it the ghost bird or the grail bird; another nickname, now more apt than ever, refers to what people exclaimed when the clamoring, starkly colored bird with a 30-inch wingspan flew by: the "Lord God" bird.

John James Audubon (his 1829 engraving, below) wrote: "I have seen it detach pieces of bark seven or eight inches in length at a single blow of its powerful bill," leaning its head "against the bark to ascertain the precise spot where the grubs were concealed, and immediately after renewing its blows with fresh vigour, all the while sounding its loud notes, as if highly delighted." Now the delight is ours.

DETAIL, JOHN J. AUDUBON / VICTORIA AND ALBERT MUSEUM, LONDON, GREAT BRITAIN / ART RESOURCE

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Reversing the Clock

Taking care of the nation's treasures requires art, history and even molecular science

TREASURES from the past need preserving. Too many families who have put their old photographs in a cardboard box in the attic or folded their antique linens and left them in the basement know the heartbreak of seeing how the passage of time takes its toll. Photographs can crack or their colors fade; a wedding dress made from lace and silk and passed down by a beloved aunt may deteriorate, crumbling to dust when touched. At the Smithsonian, conservators and conservation scientists strive to ensure that the nation's treasures, the millions of objects placed in our care, remain in the best possible condition.

Many of these experts work at the Smithsonian Center for Materials Research and Education (SCMRE), where they study classical artistic media like oil paints on canvas but also more modern materials such as metals and alloys. They learn how those substances react—and change—in various environments and what to do about it. Founded in 1963, SCMRE today unites science, biology, chemistry and physics, and the arts. With aesthetic sensibilities and a strong background in art history, center staffers investigate not only the composition of objects but their history too. Looking at a wooden chair, for example, they can determine whether it was made by hand or machine and if the wood was initially split or sawed. Examining the wood more closely, on the cellular level, they can tell the species of tree, its age and even where it grew. As SCMRE works with both the Smithsonian museums and others all over the world, it is discovering better ways to protect and restore everything from paintings and sculpture to ceremonial masks and spacecraft. Recently, SCMRE experts started visiting some of the museums in the Smithsonian Affiliations program. They are advising local curators as well as the public on how to preserve items ranging from high-school yearbooks to the rarest works of art.

SCMRE collaborated closely with the National Museum of Natural History to restore a 19th-century Hawaiian outrigger canoe, the oldest-known craft of its type. In the years since Hawaii's Queen Kapi'olani presented the canoe to the Smithsonian, in 1887, the boat's wood had deteriorated. A SCMRE team, including a senior furniture conservator, restored the bow, stern and an outrigger boom and replaced the original coconut-fiber lashings. Wherever possible they used materials that were both handmade and native to Hawaii. They were assisted by a Hawaiian volunteer and consulted with canoe historians in the islands, e-mailing questions and digital photographs and receiving valuable help in reply.

Preserving the past: A Smithsonian conservator and a Hawaiian volunteer replace coconut-fiber lashings on a 19th-century outrigger canoe.

Attending to more modern objects presents its own challenges. Before the December 2003 opening of the National Air and Space Museum's Steven F. Udvar-Hazy Center, SCMRE helped restore several aircraft and spacecraft, including an early 20th-century wooden sport glider that required the restoration of its varnish, and a Gorgon II-A guided air-to-air missile built between 1943 and 1946. The missile's transparent nose cone had been painted over, obscuring the camera that had been installed to help guide it. A chemist worked with a paintings conservator to develop the best solution for removing the nose cone's paint without damaging the plastic underneath. In so doing, SCMRE scientists have allowed researchers and now visitors to see the missile in its entirety, including the camera that marks it as perhaps the earliest example of television's use in a missile.

In an era marked by narrow specialization, SCMRE's conservators and conservation scientists remain refreshingly broad-minded—as they need to be, given that they are entrusted with so wide a variety of objects, from the most personal keepsakes to the largest machines. With skill and dedication they contend daily with time's inevitable wear. And again and again they don't just slow time, they reverse it.

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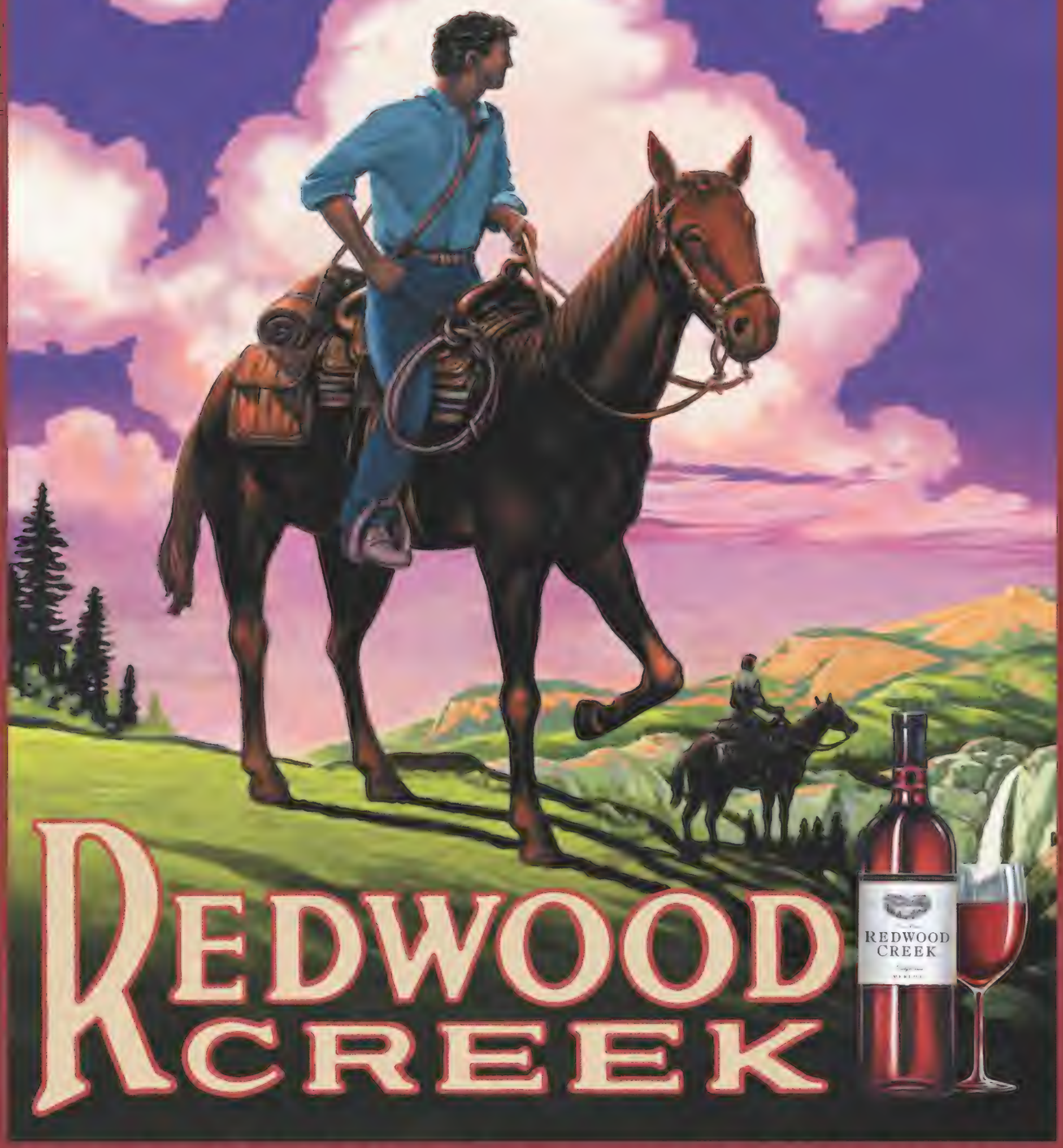
RIDE THE TRAIL TO RICHNESS



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LETTERS

Readers respond to the April issue:

OUT OF BOUNDS

THE KORUBO of the Amazon ("Out of Time") are ignorant, isolated, and, yes, fierce, but when Sydney Possuelo says "I prefer them to be violent," he betrays his arrogance. When he says Don Quixote is his hero because he tried to "transform the bad things he saw into good," Possuelo is deluded. He doesn't want to improve the circumstances of the Korubo; he wants to freeze them in their isolation so that they will continue to kill and be killed in his notion of an untouched society.

MICHAEL HANSON
SAN DIEGO, CALIFORNIA

I HAD ALWAYS thought that the Amazon tribes had been modernized by now, but it is moving to know that tribes who have had no contact with the outside world still exist. Possuelo should be commended for preserving their way of life and keeping outsiders at bay. We have no right to force our views or lifestyles on a civilization that has been unchanged for thousands of years. Every effort should be made to protect these people from us.

ARTHUR SCOTT
HAVASU CITY, ARIZONA

PERHAPS there was something I missed in Possuelo's explanation of his philosophy of maintaining the isolation of the tribes in the Javari Valley of Brazil. In one breath he proclaims his belief that pictures of the outside world will only encourage tribal members to visit it, and that they are better off without interference of any kind. The next moment he is bringing in a nurse to provide medical treatments, and even describing an automobile to members of the Korubo. Truly protecting these tribes would involve completely removing

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LETTERS

himself and all exposure to modernity from the Javari Valley. Although I agree with Possuelo's ideas, his implementation leaves much to be desired.

J. DRUSILLA CARTER
COLUMBIA, SOUTH CAROLINA

A NEW DARK AGES?

AFTER READING "Evolution on Trial," about the Scopes trial, I find myself wondering if we are returning to a new Dark Ages, where all of nature must conform to the Bible. It is appalling that every year many of our young people pass through the education system taught by science teachers who don't believe in evolution. The vast majority of scientists consider "intelligent design" and "young earth" theories just another part of the creationist agenda, and yet many science teachers seem to feel more comfortable with these concepts than with the scientifically accepted theories.

EUGENE CONNELL
INDEPENDENCE, OREGON

I FIND IT appalling that SMITHSONIAN would dignify creationists' views by presenting them on equal footing with evolutionists. Accepting matters on faith alone is antithetical to the scientific method, which tests and rejects concepts based on rigorous standards of evidence. When people such as Kurt Wise make preposterous comments like "Scripture trumps interpretation of physical data," they are not scientists.

BILL PAI
ALAMEDA, CALIFORNIA

Our article about the Scopes trial, which took place 80 years ago in Dayton, Tenn., reported as well on its legacy, including townspeoples' anti-evolution beliefs. As for the magazine's view, it was summed up by Eugenie C. Scott, of the National Center for Science Education: "The idea that evolution is shaky or just a theory—this is absolutely amazing to scientists." —Ed.

CORRECTIONS: *A caption on page 95 misidentified the man on the left. He is Rod Beattie, portraying First Sgt. James Butler. In "Hope Sleuth Cracks Case?" the names of Stephen and Nancy Attaway, project participants, were misspelled.*

Please send letters to LettersEd@simag.si.edu or to **Letters, Smithsonian, MRC 951, P.O. Box 37012, Washington, D.C. 20013.** Include a telephone number and address. Letters may be edited for clarity or space. Because of the high volume of mail we receive, we cannot respond to all letters. Send queries about the Smithsonian Institution to info@si.edu or to VIARC, Public Inquiry Mail Service, P.O. Box 37012, Washington, D.C. 20013.

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June 1970

THE YEAR WE WERE BORN

A LOOK BACK AT THE WORLD IN SMITHSONIAN MAGAZINE'S FIRST YEAR

CELEBRATING 35 YEARS SMITHSONIAN MAGAZINE

WHERE ARE THEY NOW?

ELIZABETH PLATZ

FIRST FEMALE LUTHERAN MINISTER

At her November 22, 1970, ordination, Platz gives communion to her mother at the University of Maryland chapel.

AFTER THE Lutheran Church in America changed its bylaws to allow the ordination of women on June 29, 1970, Elizabeth Platz decided to pursue the opportunity then available to her. "I was not interested in ordination in terms of women's rights," she says today. "I was more interested in whether I was the kind of person who could be a good pastor." Despite opposition from some (hate mail to Platz included such invectives as "You are the Whore of Babylon"), she became the first female pastor ordained into the Lutheran Ministry in North America, November 22, 1970.

Platz, 64, currently serves as Lutheran chaplain at the University of Maryland at College Park, where she provides services such as counseling and marriage preparation to undergraduate and graduate students. She urges young people to follow her example. "While others will try to mold you," she says, "you must discover on your own what work makes you happy." —*MIMI KIRK*

On June 21, Edson Arantes do Nascimento, better known as Pelé, or the "King of Football," scored one goal and two assists to lead Brazil to a 4-1 victory over Italy in the World Cup, making Brazil the first team to win the tournament three times. In 2002, Pelé's jersey from that game sold at auction for a record $224,951.

IN THE NEWS

Charles Manson, 35, and three of his cult-like "family" members (Susan Atkins, 21, Leslie Van Houten, 20, and Patricia Krenwinkel, 22) begin trial in Los Angeles June 16 for the murder of actress Sharon Tate and six others. Denied parole from a life sentence in 2002, Manson will not be eligible again until 2007. Atkins, Van Houten and Krenwinkel also continue to serve life sentences.

Dr. H. Gobind Khorana and his colleagues at the University of Wisconsin at Madison complete the first synthesis of a gene June 2. The accomplishment prompts Dr. George Kistiakowsky, science adviser to President Dwight Eisenhower, to fret that "a new Hitler may [someday] be able to reproduce hundreds of his own replicas." The mapping of the human genome was completed in April 2003.

THE LIST

1970 Price Index

Gasoline $.36/gallon
Median Income $8,734/year
Median Rent $108/month
Median Home $17,000
Bacon $.97/pound
Eggs $.51/dozen
Bread $.24/loaf
Vitamin D Milk $1.14/gallon
First-Class Postage Stamp $.06
Harvard College Tuition $2,600/year

COMINGS & GOINGS

BORN: Chris O'Donnell, Actor, June 26

BORN: Phil Mickelson, Golfer, June 16

DIED: Sukarno, Indonesian President, 69, June 21

DIED: E. M. Forster, British Novelist, 91, June 7

"Were I in your position, you know, I might well be a member of your group."

—VICE PRESIDENT AGNEW, TO A GROUP OF PROFESSORS WHO HAD URGED HIM TO TONE DOWN HIS CRITICISM OF YOUNG PEOPLE, IN THE JUNE 5 *NEW YORK TIMES*

BETTMANN / CORBIS; ELIZABETH PLATZ COLLECTION; RIGHT: AP / WIDE WORLD PHOTOS (3); FREDERICK M. BROWN / GETTY IMAGES; AMY SANCETTA / AP / WIDE WORLD PHOTOS; PICTORIAL PARADE / HULTON ARCHIVE / GETTY IMAGES; HULTON-DEUTSCH COLLECTION / CORBIS; USPS / SMITHSONIAN NATIONAL POSTAL MUSEUM; WALLY MCNAMEE / CORBIS

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Please read this summary carefully, and then ask your doctor about NEXIUM. No advertisement can provide all the information needed to prescribe a drug. This advertisement does not take the place of careful discussions with your doctor. Only your doctor has the training to weigh the risks and benefits of a prescription drug for you.

NEXIUM® (esomeprazole magnesium)

20-mg, 40-mg Delayed-Release Capsules

BRIEF SUMMARY Before prescribing NEXIUM, please see full Prescribing Information. **INDICATIONS AND USAGE** NEXIUM is indicated for the short-term treatment (4 to 8 weeks) in the healing and symptomatic resolution of diagnostically confirmed erosive esophagitis; the maintenance of symptom resolution and healing of erosive esophagitis (controlled studies do not extend beyond 6 months); and for the treatment of heartburn and other symptoms associated with GERD; and for risk reduction of NSAID-associated gastric ulcer. **CONTRAINDICATIONS** NEXIUM is contraindicated in patients with known hypersensitivity to any component of the formulation or to substituted benzimidazoles. **PRECAUTIONS** Symptomatic response to therapy with NEXIUM does not preclude the presence of gastric malignancy. Atrophic gastritis has been noted occasionally in gastric corpus biopsies from patients treated long-term with omeprazole, of which NEXIUM is an enantiomer. **Information for Patients** NEXIUM Delayed-Release Capsules should be swallowed whole and taken at least one hour before meals. For patients who have difficulty swallowing capsules, one tablespoon of applesauce can be added to an empty bowl and the NEXIUM Delayed-Release Capsule can be opened, and the pellets carefully emptied onto the applesauce. The pellets should be mixed with the applesauce and then swallowed immediately. The applesauce used should not be hot and should be soft enough to be swallowed without chewing. The pellets should not be chewed or crushed. The pellet/applesauce mixture should not be stored for future use. Antacids may be used while taking NEXIUM. **Drug Interactions** Esomeprazole is extensively metabolized in the liver by CYP2C19 and CYP3A4. *In vitro* and *in vivo* studies have shown that esomeprazole is not likely to inhibit CYPs 1A2, 2A6, 2C9, 2D6, 2E1 and 3A4. No clinically relevant interactions with drugs metabolized by these CYP enzymes would be expected. Drug interaction studies have shown that esomeprazole does not have any clinically significant interactions with phenytoin, warfarin, quinidine, clarithromycin or amoxicillin. Post-marketing reports of changes in prothrombin measures have been received among patients on concomitant warfarin and esomeprazole therapy. Increases in INR and prothrombin time may lead to abnormal bleeding and even death. Patients treated with proton pump inhibitors and warfarin concomitantly may need to be monitored for increases in INR and prothrombin time. Esomeprazole may potentially interfere with CYP2C19, the major esomeprazole metabolizing enzyme. Coadministration of esomeprazole 30 mg and diazepam, a CYP2C19 substrate, resulted in a 45% decrease in clearance of diazepam. Increased plasma levels of diazepam were observed 12 hours after dosing and onwards. However, at that time, the plasma levels of diazepam were below the therapeutic interval, and thus this interaction is unlikely to be of clinical relevance. Coadministration of oral contraceptives, diazepam, phenytoin, or quinidine did not seem to change the pharmacokinetic profile of esomeprazole. Studies evaluating concomitant administration of esomeprazole and either naproxen (non-selective NSAID) or rofecoxib (COX-2 selective NSAID) did not identify any clinically relevant changes in the pharmacokinetic profiles of esomeprazole or these NSAIDs. Esomeprazole inhibits gastric acid secretion. Therefore, esomeprazole may interfere with the absorption of drugs where gastric pH is an important determinant of bioavailability (eg, ketoconazole, iron salts and digoxin). **Carcinogenesis, Mutagenesis, Impairment of Fertility** The carcinogenic potential of esomeprazole was assessed using omeprazole studies. In two 24-month oral carcinogenicity studies in rats, omeprazole at daily doses of 1.7, 3.4, 13.8, 44.0 and 140.8 mg/kg/day (about 0.7 to 57 times the human dose of 20 mg/day expressed on a body surface area basis) produced gastric ECL cell carcinoids in a dose-related manner in both male and female rats; the incidence of this effect was markedly higher in female rats, which had higher blood levels of omeprazole. Gastric carcinoids seldom occur in the untreated rat. In addition, ECL cell hyperplasia was present in all treated groups of both sexes. In one of these studies, female rats were treated with 13.8 mg omeprazole/kg/day (about 5.6 times the human dose on a body surface area basis) for 1 year, then followed for an additional year without the drug. No carcinoids were seen in these rats. An increased incidence of treatment-related ECL cell hyperplasia was observed at the end of 1 year (94% treated vs 10% controls). By the second year the difference between treated and control rats was much smaller (46% vs 26%) but still showed more hyperplasia in the treated group. Gastric adenocarcinoma was seen in one rat (2%). No similar tumor was seen in male or female rats treated for 2 years. For this strain of rat no similar tumor has been noted historically, but a finding involving only one tumor is difficult to interpret. A 78-week mouse carcinogenicity study of omeprazole did not show increased tumor occurrence, but the study was not conclusive. Esomeprazole was negative in the Ames mutation test, in the *in vivo* rat bone marrow cell chromosome aberration test, and the *in vivo* mouse micronucleus test. Esomeprazole, however, was positive in the *in vitro* human lymphocyte chromosome aberration test. Omeprazole was positive in the *in vitro* human lymphocyte chromosome aberration test, the *in vivo* mouse bone marrow cell chromosome aberration test, and the *in vivo* mouse micronucleus test. The potential effects of esomeprazole on fertility and reproductive performance were assessed using omeprazole studies. Omeprazole at oral doses up to 138 mg/kg/day in rats (about 56 times the human dose on a body surface area basis) was found to have no effect on reproductive performance of parental animals. **Pregnancy** *Teratogenic Effects. Pregnancy Category B* Teratology studies have been performed in rats at oral doses up to 280 mg/kg/day (about 57 times the human dose on a body surface area basis) and in rabbits at oral doses up to 86 mg/kg/day (about 35 times the human dose on a body surface area basis) and have revealed no evidence of impaired fertility or harm to the fetus due to esomeprazole. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed. Teratology studies conducted with omeprazole in rats at oral doses up to 138 mg/kg/day (about 56 times the human dose on a body surface area basis) and in rabbits at doses up to 69 mg/kg/day (about 56 times the human dose on a body surface area basis) did not disclose any evidence for a teratogenic potential of omeprazole. In rabbits, omeprazole in a dose range of 6.9 to 69.1 mg/kg/day (about 5.5 to 56 times the human dose on a body surface area basis) produced dose-related increases in embryo-lethality, fetal resorptions, and pregnancy disruptions. In rats, dose-related embryo/fetal toxicity and postnatal developmental toxicity were observed in offspring resulting from parents treated with omeprazole at 13.8 to 138.0 mg/kg/day (about 5.6 to 56 times the human doses on a body surface area basis). There are no adequate and well-controlled studies in pregnant women. Sporadic reports have been received of congenital abnormalities occurring in infants born to women who have received omeprazole during pregnancy. **Nursing Mothers** The excretion of esomeprazole in milk has not been studied. However, omeprazole concentrations have been measured in breast milk of a woman following oral administration of 20 mg. Because esomeprazole is likely to be excreted in human milk, because of the potential for serious adverse reactions in nursing infants from esomeprazole, and because of the potential for tumorigenicity shown for omeprazole in rat carcinogenicity studies, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother. **Pediatric Use** Safety and effectiveness in pediatric patients have not been established. **Geriatric Use** Of the total number of patients who received NEXIUM in clinical trials, 1459 were 65 to 74 years of age and 354 patients were 75 years of age. **ADVERSE REACTIONS** The safety of NEXIUM was evaluated in over 15,000 patients (aged 18-84 years) in clinical trials worldwide including over 8,500 patients in the United States and over 6,500 patients in Europe and Canada. Over 2,900 patients were treated in long-term studies for up to 6-12 months. In general, NEXIUM was well tolerated in both short- and long-term clinical trials. The safety in the treatment of healing of erosive esophagitis was assessed in four randomized comparative clinical trials, which included 1,240 patients on NEXIUM 20 mg, 2,434 patients on NEXIUM 40 mg, and 3,008 patients on omeprazole 20 mg daily. The most frequently occurring adverse events (1%) in all three groups was headache (5.5, 5.0, and 3.8, respectively) and diarrhea (no difference among the three groups). Nausea, flatulence, abdominal pain, constipation, and dry mouth occurred at similar rates among patients taking NEXIUM or omeprazole. Additional adverse events that were reported as possibly or probably related to NEXIUM with an incidence < 1% are listed below by body system: ***Body as a Whole:*** abdomen enlarged, allergic reaction, asthenia, back pain, chest pain, chest pain substernal, facial edema, peripheral edema, hot flushes, fatigue, fever, flu-like disorder, generalized edema, leg edema, malaise, pain, rigors; ***Cardiovascular:*** flushing, hypertension, tachycardia; ***Endocrine:*** goiter; ***Gastrointestinal:*** bowel irregularity, constipation aggravated, dyspepsia, dysphagia, dysplasia GI, epigastric pain, eructation, esophageal disorder, frequent stools, gastroenteritis, GI hemorrhage, GI symptoms not otherwise specified, hiccup, melena, mouth disorder, pharynx disorder, rectal disorder, serum gastrin increased, tongue disorder, tongue edema, ulcerative stomatitis, vomiting; ***Hearing:*** earache, tinnitus; ***Hematologic:*** anemia, anemia hypochromic, cervical lymphoadenopathy, epistaxis, leukocytosis, leukopenia, thrombocytopenia; ***Hepatic:*** bilirubinemia, hepatic function abnormal, SGOT increased, SGPT increased; ***Metabolic/Nutritional:*** glycosuria, hyperuricemia, hyponatremia, increased alkaline phosphatase, thirst, vitamin B12 deficiency, weight increase, weight decrease; ***Musculoskeletal:*** arthralgia, arthritis aggravated, arthropathy, cramps, fibromyalgia syndrome, hernia, polymyalgia rheumatica; ***Nervous System/Psychiatric:*** anorexia, apathy, appetite increased, confusion, depression aggravated, dizziness, hypertonia, nervousness, hypoesthesia, impotence, insomnia, migraine, migraine aggravated, paresthesia, sleep disorder, somnolence, tremor, vertigo, visual field defect; ***Reproductive:*** dysmenorrhea, menstrual disorder, vaginitis; ***Respiratory:*** asthma aggravated, coughing, dyspnea, larynx edema, pharyngitis, rhinitis, sinusitis; ***Skin and Appendages:*** acne, angioedema, dermatitis, pruritus, pruritus ani, rash, rash erythematous, rash maculopapular, skin inflammation, sweating increased, urticaria; ***Special Senses:*** otitis media, parosmia, taste loss, taste perversion; ***Urogenital:*** abnormal urine, albuminuria, cystitis, cysturia, fungal infection, hematuria, micturition frequency, moniliasis, genital moniliasis, polyuria; ***Visual:*** conjunctivitis, vision abnormal. Endoscopic findings that were reported as adverse events include: duodenitis, esophagitis, esophageal stricture, esophageal ulceration, esophageal varices, gastric ulcer, gastritis, hernia, benign polyps or nodules, Barrett's esophagus, and mucosal discoloration. Two placebo-controlled studies were conducted in 710 patients for the treatment of symptomatic gastroesophageal reflux disease. The most common adverse events that were reported as possibly or probably related to NEXIUM were diarrhea (4.3%), headache (3.9%), and abdominal pain (3.6%). Postmarketing Reports – There have been spontaneous reports of adverse events with postmarketing use of esomeprazole. These reports have included rare cases of anaphylactic reaction and myalgia, severe dermatologic reactions, including toxic epidermal necrolysis (TEN, some fatal), Stevens-Johnson syndrome, and erythema multiforme, and pancreatitis. Very rarely, hepatitis with or without jaundice has been reported. Other adverse events not observed with NEXIUM, but occurring with omeprazole can be found in the omeprazole package insert, **ADVERSE REACTIONS** section. **OVERDOSAGE** A single oral dose of esomeprazole at 510 mg/kg (about 103 times the human dose on a body surface area basis), was lethal to rats. The major signs of acute toxicity were reduced motor activity, changes in respiratory frequency, tremor, ataxia, and intermittent clonic convulsions. There have been some reports of overdosage with esomeprazole. Reports have been received of overdosage with omeprazole in humans. Doses ranged up to 2,400 mg (120 times the usual recommended clinical dose). Manifestations were variable, but included confusion, drowsiness, blurred vision, tachycardia, nausea, diaphoresis, flushing, headache, dry mouth, and other adverse reactions similar to those seen in normal clinical experience (see omeprazole package insert-**ADVERSE REACTIONS**). No specific antidote for esomeprazole is known. Since esomeprazole is extensively protein bound, it is not expected to be removed by dialysis. In the event of overdosage, treatment should be symptomatic and supportive. As with the management of any overdose, the possibility of multiple drug ingestion should be considered. For current information on treatment of any drug overdose, a certified Regional Poison Control Center should be contacted. Telephone numbers are listed in the Physicians' Desk Reference (PDR) or local telephone book. **DOSAGE AND ADMINISTRATION** Please see full Prescribing Information for recommended adult dosages and dosage adjustments for **Special Populations** for NEXIUM.

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CHIEF LOBBYIST

HE MADE LITTLE HEADWAY WITH PRESIDENT GRANT, BUT RED CLOUD WON OVER THE 19TH CENTURY'S GREATEST PHOTOGRAPHERS **BY ANNE BROACHE**

NATIONAL MUSEUM OF NATURAL HISTORY, SMITHSONIAN INSTITUTION. NATIONAL ANTHROPOLOGICAL ARCHIVES

"You have not treated me as I ought to have been treated," the great Lakota chief (at 51, in an 1872 portrait by Alexander Gardner) told U.S. officials, adding: "But now I am for peace."

RED CLOUD started down the path of becoming the most photographed American Indian of the 19th century one spring morning in 1872, a few blocks from the White House. Before meeting with President Ulysses S. Grant, the Lakota chief agreed to sit for Mathew Brady, famed for his Civil War-era photographs and his portraits of the prominent. Two days later, Red Cloud posed at the nearby studio of Alexander Gardner, Brady's former assistant and one of the founders of American photojournalism. That session yielded a picture (left) that was a bestseller in its day and is one of the earliest, most striking photographs of an Indian chief in his prime.

Aside from the tribal blanket around his waist, Red Cloud's dress is simple. "My great-great-grandfather was both a leader and a warrior, but he was also a man," says Dorene Red Cloud, 34, an artist in Gardner, Massachusetts. The chief, she says, wanted Washington leaders to see him as a diplomat, "minus the glamour or pomp or circumstance of feathers and beads."

Not much is known about Red Cloud's visit to Gardner's studio, says Frank Goodyear III, a curator of photographs for the National Portrait Gallery and author of the 2003 book *Red Cloud: Photographs of a Lakota Chief*. Gardner made at least four different plates, and the session was arranged by a wealthy land speculator named William Blackmore, who was collecting photographs for a museum about Native peoples he'd opened in 1867 in his hometown of Salisbury, England.

The Scottish-born Gardner, once a

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Glasgow newspaperman, had been living in Washington since 1856. He started as Brady's assistant and occasional bookkeeper, but launched his own studio in 1863, after what D. Mark Katz, in his *Witness to an Era: The Life and Photographs of Alexander Gardner*, calls an "amicable" break with Brady. In 1865, Gardner published a volume of frontline Civil War scenes, *Gardner's Photographic Sketch Book of the War*. He also won recognition for his images of Abraham Lincoln and other leading figures. He made his mark not with technical innovations but by "affecting public awareness," Katz writes, whether through "authentic images of the horrors of the battlefield" or mug shots of the Lincoln assassination conspirators. After the war, Gardner briefly went West, where he documented treaty signings between Indians and U.S. officials. Gardner retired in 1879 and died three years later at age 61.

The best-known Indian leader of his time, Red Cloud had become a warrior in clashes with the U.S. military in the Northern Plains. In 1868, he reluctantly signed the Fort Laramie Treaty, which reaffirmed the Lakota's hunting rights, sectioned off the Great Sioux Reservation and required the government to remove military forts.

But the government didn't hold up its end of the deal, and even built a new fort on Lakota soil. After meeting with Grant the first time, in 1870, a frustrated Red Cloud was quoted as telling Secretary of the Interior Jacob Cox that the treaty was "all lies." He added: "We have been driven far enough; we want what we ask for." Officials, meanwhile, had hoped to wangle from Red Cloud access to the Lakota's gold-rich Black Hills (which they obtained years later). During the chief's second visit to Grant, in 1872, Red Cloud sensed more respect, and as a kind of diplomatic gesture, Goodyear says, he agreed to have his picture taken.

Gardner, circa 1860

In years to come, Red Cloud would journey from his home in Pine Ridge, South Dakota, to Washington eight more times and hobnob with officials from three other administrations, frequently on his own initiative. Photographers clamored to capture him on film, and the 128 known photographs of the chief trace his quest to hang onto influence while most people believed American Indian culture would go the way of the dinosaurs. In photographs from the 1880s, Red Cloud sports short hair and tailored suits, which he had hoped would help win over U.S. leaders. Those efforts proved futile, and he let his hair grow. The final portraits show a frail, white-haired, nearly blind old man, seemingly wistful for his tribe's glory days. He died in 1909 at age 88.

But at Gardner's studio in 1872, Red Cloud fixes his gaze directly forward—a "strikingly modern" view, Goodyear says, that distinguishes this image from the rest: "He's at the top of his game as a diplomat and tribal leader. You can sense this is not a defeated man."

"My heart is heavy," said an elderly Red Cloud (in a 1905 Edward Curtis photo).

ANNE BROACHE is a recent graduate of Northwestern and an intern at SMITHSONIAN.

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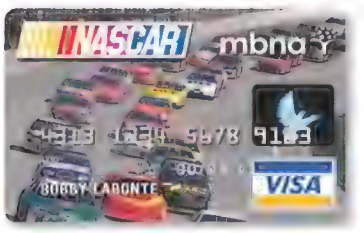

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[*Elephant-Shrew, 2005* SMITHSONIAN NATIONAL ZOO]

SHREWD CONFIGURATION

WITH A TRUNK LIKE A PACHYDERM AND AN ANTEATER'S TONGUE, THE ELEPHANT-SHREW LOOKS LIKE A MOUSE DESIGNED BY A COMMITTEE **BY RICHARD CONNIFF**

THEY ARE A CONUNDRUM, a Dr. Seuss sort of animal seemingly put together from spare parts. The sign on their enclosure at the National Zoo in Washington, D.C. calls them elephant-shrews, suggesting the unlikeliest of possibilities, a cross between the largest land mammal on earth and the smallest. Like elephants, they have delicate, quivering trunklike snouts, for rooting through the leaf litter. Like shrews, they eat insects, flicking elongated tongues from underneath the trunk to snap up their unfortunate victims. Their bodies are furry and rodentlike, with glossy black eyes and long, leathery tails.

But good grief, where did they get those spindly antelope legs? Elephant-shrews, unlike many other small mammals, don't scuttle down burrows to escape hungry predators. In-

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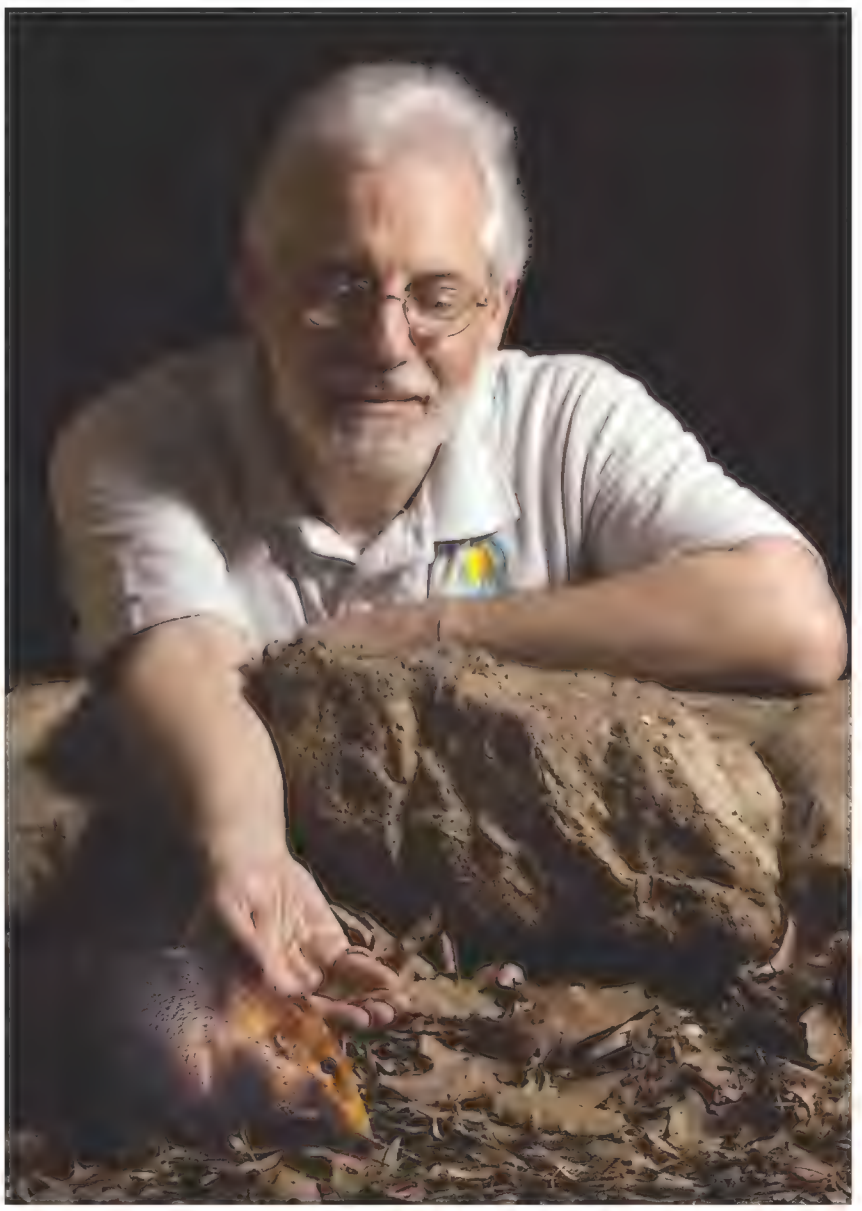
"I know you're there, but I can likely outrun you if you attack."

stead, they run like hell. Galen Rathbun, a California Academy of Sciences biologist who has spent much of his career studying elephant-shrews, suggests that they are fast enough to be cocky about it. When they spot an approaching predator, they may simply sit still and slap that elongated tail against the leaf litter. "The sharp sound produced by this behavior probably communicates a message to the predator," says Rathbun: "I know you're there, but you are outside my flight distance, and I can probably outrun you if you attack." Savvy predators take the hint. Given the combination of insect-eating and speed, says Rathbun, it would probably be more accurate to think of elephant-shrews as dwarf anteater-antelopes. (Or avoid misinterpretation altogether and call them by their Bantu name, *sengi*.)



Biologist Kessler (above) says that the National Zoo's elephant-shrews "habituated to humans by the end of the first day."

Elephant-shrews are native only to Africa, where 15 species inhabit deserts, savannas and forests. Since scientists discovered them in the mid-1800s, they have variously described these animals as insectivores (for example, shrews and moles), ungulates (antelopes and the like), even lagomorphs (primarily rabbits). But DNA analyses now place them alone in their own order, Macroscelidea. DNA also suggests they are part of the newly proposed superorder Afrotheria, whose members emerged from a common ancestor some 100 million years ago. Though a small group, Afrotheria are decidedly diverse, ranging from tenrecs, hedgehoglike creatures, some weighing less than a quarter-ounce, to elephants weighing 11,000 pounds, and also including aardvarks, manatees, hyraxes and golden moles. But just this spring, researchers studying the fossils of extinct species suggested in the journal *Nature* that the Afrotherians, including elephant-shrews, may actually have originated in North America.

The pair at the National Zoo are black-and-rufous giant elephant-shrews, native to the forests of Kenya and Tanzania, where they are endangered because of encroaching population. In the past, this species, *Rhynchocyon petersi*, proved difficult to breed in captivity. But five years ago, the Zoological Society of Philadelphia and the Cincinnati Zoo launched a new breeding effort: biologists trained the elephant-shrews to clamber onto a scale to be weighed, making possible a diagnosis of pregnancy. Video cameras helped determine whether a nest, little more than a loose pile of leaves, contained offspring, so keepers could avoid disturbing them. (Newborns remain in the nest for three weeks. Though the male and female are monogamous, elephant-shrew dads don't do much beyond defending the territory from rival males.)

Within a year, the breeding program began to produce. The pair of shrews at the National Zoo are among the blessed events, born last September to a father from Cincinnati and a mother from Philadelphia. Kidogo (Swahili for "little") and Panya (Swahili for "mouse") are brothers; the plan is to rotate one of them to another zoo as females become available. Meanwhile, they share a home with a couple of hornbills, birds also native to East Africa.

Unlike many other small mammals, which tend to be nocturnal, elephant-shrews are active by day. One recent morning, Kidogo wandered around his cage, his proboscis tapping the ground. Now and then he paused, lifted it to sample the air, and swung it toward the spectators on the other side of the glass, as if to say, "I know you're there. Why can't I smell you?" Panya, meanwhile, was furiously piling up leaves for a nest, flinging some of them behind him like a demented homeowner raking his yard.

Small-mammal biologist David S. Kessler says he hopes the exhibition will help visitors, at the very least, to appreciate that not all small, furry mammals are rats. These guys, he says, are "charismatic mini-vertebrates."

RICHARD CONNIFF is the author of The Ape in the Corner Office, *to be published by Crown this September.*

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Rev. May 2003a

Brief Summary

ALLEGRA®
(fexofenadine hydrochloride)
Capsules and Tablets

INDICATIONS AND USAGE Seasonal Allergic Rhinitis ALLEGRA is indicated for the relief of symptoms associated with seasonal allergic rhinitis in adults and children 6 years of age and older. Symptoms treated effectively were sneezing, rhinorrhea, itchy nose/palate/throat, itchy/watery/red eyes. **Chronic Idiopathic Urticaria** ALLEGRA is indicated for treatment of uncomplicated skin manifestations of chronic idiopathic urticaria in adults and children 6 years of age and older. It significantly reduces pruritus and the number of wheals. **CONTRAINDICATIONS** ALLEGRA is contraindicated in patients with known hypersensitivity to any of its ingredients. **PRECAUTIONS Drug Interaction with Erythromycin and Ketoconazole** Fexofenadine hydrochloride has been shown to exhibit minimal (ca. 5%) metabolism. However, co-administration of fexofenadine hydrochloride with ketoconazole and erythromycin led to increased plasma levels of fexofenadine hydrochloride. Fexofenadine hydrochloride had no effect on the pharmacokinetics of erythromycin and ketoconazole. In two separate studies, fexofenadine hydrochloride 120 mg twice daily (two times the recommended twice daily dose) was co-administered with erythromycin 500 mg every 8 hours or ketoconazole 400 mg once daily under steady state conditions to normal, healthy adult volunteers (n=24, each study). No differences in adverse events or QT intervals were observed when patients were administered fexofenadine hydrochloride alone or in combination with erythromycin or ketoconazole. The findings of these studies are summarized in the following table:

Effects on steady-state fexofenadine hydrochloride pharmacokinetics after 7 days of co-administration with fexofenadine hydrochloride 120 mg every 12 hours (two times the recommended twice daily dose) in normal volunteers (n=24)

Concomitant Drug	C_{max} *Peak plasma concentration*	AUC_{0-t} *Extent of systemic exposure*
Erythromycin 500 mg every 8 hrs	+82%	+109%
Ketoconazole 400 mg once daily	+135%	+164%

The changes in plasma levels were within the range of plasma levels achieved in adequate and well-controlled clinical trials. The mechanism of these interactions has been evaluated *in vitro*, *in situ*, and *in vivo* animal models. These studies indicate that ketoconazole or erythromycin co-administration enhances fexofenadine gastrointestinal absorption. *In vivo* animal studies also suggest that in addition to increasing absorption, ketoconazole decreases fexofenadine hydrochloride gastrointestinal secretion while erythromycin may also decrease biliary excretion. **Drug Interactions with Antacids** Administration of 120 mg of fexofenadine hydrochloride (2 x 60 mg capsule) within 15 minutes of an aluminum and magnesium hydroxide containing antacid (Maalox®) decreased fexofenadine AUC by 41% and C_{max} by 43%. ALLEGRA should not be taken closely in time with aluminum and magnesium containing antacids. **Carcinogenesis, Mutagenesis, Impairment of Fertility** The carcinogenic potential and reproductive toxicity of fexofenadine hydrochloride were assessed in separate studies with adequate fexofenadine hydrochloride exposure based on plasma area under the concentration vs. time [AUC] values). No evidence of carcinogenicity was observed in an 18-month study in mice and in a 24-month study in rats at oral doses up to 150 mg/kg of terfenadine, which led to fexofenadine exposures that were respectively approximately 3 and 5 times the exposure from the maximum recommended daily oral dose of fexofenadine hydrochloride in adults and children. In *in vitro* Bacterial Reverse Mutation, CHO-HGPRT Forward Mutation and Rat Lymphocyte Chromosomal Aberration assays, and the *in vivo* Mouse Bone Marrow Micronucleus assay tests, fexofenadine hydrochloride revealed no evidence of mutagenicity. In rat fertility studies, dose-related reductions in implants and increases in postimplantation losses were observed at an oral dose of 150 mg/kg of terfenadine which led to fexofenadine hydrochloride exposures that were approximately 3 times the exposure of the maximum recommended daily oral dose of fexofenadine hydrochloride in adults. **Pregnancy Teratogenic Effects: Category C.** There was no evidence of teratogenicity in rats or rabbits at oral doses of terfenadine up to 300 mg/kg which led to fexofenadine exposures that were approximately 4 and 21 times, respectively, the exposure from the maximum recommended daily oral dose of fexofenadine in adults. There are no adequate and well controlled studies in pregnant women. Fexofenadine should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. **Nonteratogenic Effects.** Dose-related decreases in pup weight gain and survival were observed in rats exposed to an oral dose of 150 mg/kg of terfenadine (approximately 3 times the maximum recommended daily oral dose of fexofenadine hydrochloride in adults based on comparison of fexofenadine hydrochloride AUCs). **Nursing Mothers** There are no adequate and well-controlled studies in women during lactation. Because many drugs are excreted in human milk, caution should be exercised when fexofenadine hydrochloride is administered to a nursing woman. **Pediatric Use** The recommended dose in patients 6 to 11 years of age is based on cross-study comparison of the pharmacokinetics of ALLEGRA in adults and pediatric patients and on the safety profile of fexofenadine hydrochloride in both adult and pediatric patients at doses equal to or higher than the recommended doses. The safety of ALLEGRA tablets at a dose of 30 mg twice daily has been demonstrated in 498 pediatric patients 6 to 11 years of age in two placebo-controlled 2-week seasonal allergic rhinitis trials. The safety of ALLEGRA for the treatment of chronic idiopathic urticaria in patients 6 to 11 years of age is based on cross-study comparison of the pharmacokinetics of ALLEGRA in adult and pediatric patients and on the safety profile of fexofenadine hydrochloride in both adult and pediatric patients at doses equal to or higher than the recommended dose. The effectiveness of ALLEGRA for the treatment of seasonal allergic rhinitis in patients 6 to 11 years of age was demonstrated in one final trial in which ALLEGRA tablets 30 mg twice daily significantly reduced total symptom scores compared to placebo, along with extrapolation of demonstrated efficacy in patients ages 12 years and above and the pharmacokinetic comparisons in adults and children. The effectiveness of ALLEGRA for the treatment of chronic idiopathic urticaria in patients 6 to 11 years of age is based on an extrapolation of the demonstrated efficacy of ALLEGRA in adults with this condition and the likelihood that the disease course, pathophysiology, and the drugs effect are substantially similar in children to that of adult patients. Three clinical safety studies comparing 15 mg BID (n=254) and 30 mg BID (n=330) of an experimental formulation of fexofenadine to placebo (n=470) have been conducted in pediatric patients aged 6 months to 5 years. In general, fexofenadine hydrochloride was well tolerated in these studies. No unexpected adverse events were seen given the known safety profile of fexofenadine and the adverse reactions for this patient population (see ADVERSE REACTIONS and CLINICAL PHARMACOLOGY). The safety and effectiveness of fexofenadine hydrochloride in pediatric patients under 6 years of age have not been established. **Geriatric Use** Clinical studies of ALLEGRA tablets and capsules did not include sufficient numbers of subjects aged 65 years and over to determine whether this population responds differently from younger patients. Other reported clinical experience has not identified differences in responses between the geriatric and younger patients. This drug is known to be substantially excreted by the kidney, and the risk of toxic reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and may be useful to monitor renal function (see CLINICAL PHARMACOLOGY). **ADVERSE REACTIONS Seasonal Allergic Rhinitis Adults.** In placebo controlled seasonal allergic rhinitis clinical trials in patients 12 years of age and older, which included 2461 patients receiving fexofenadine hydrochloride capsules at doses of 20 mg to 240 mg twice daily, adverse events were similar in fexofenadine hydrochloride and placebo treated patients. All adverse events that were reported by greater than 1% of patients who received the recommended daily dose of fexofenadine hydrochloride 60 mg capsules twice daily, and that were more common with fexofenadine hydrochloride than placebo, are listed in Table 1. In a placebo-controlled clinical study in the United States, which included 570 patients aged 12 years and older receiving fexofenadine hydrochloride tablets at doses of 120 or 180 mg once daily, adverse events were similar to fexofenadine hydrochloride and placebo treated patients. Table 1 also lists adverse experiences that were reported by greater than 2% of patients treated with fexofenadine hydrochloride tablets at doses of 180 mg once daily and that were more common with fexofenadine hydrochloride than placebo. The incidence of adverse events, including drowsiness, was not dose related and was similar across subgroups defined by age, gender, and race.

Table 1
Adverse experiences in patients ages 12 years and older reported in placebo-controlled seasonal allergic rhinitis clinical trials in the United States

Twice daily dosing with fexofenadine capsules at rates of greater than 1%

Adverse experience	*Fexofenadine 60 mg Twice Daily n=670*	*Placebo Twice Daily n=677*
Viral Infection (cold, flu)	2.5%	1.8%
Nausea	1.6%	1.3%
Dysmenorrhea	1.5%	0.3%
Drowsiness	1.3%	0.9%
Dyspepsia	1.2%	0.6%
Fatigue	1.2%	0.9%

Once daily dosing with fexofenadine hydrochloride tablets at rates of greater than 2%

Adverse experience	*Fexofenadine 180 mg once daily n=269*	*Placebo n=293*
Headache	16.6%	17.0%
Upper Respiratory Tract Infection	5.2%	4.8%
Back Pain	2.6%	1.4%

The frequency and magnitude of laboratory abnormalities were similar in fexofenadine hydrochloride and placebo-treated patients. **Pediatric.** Table 2 lists adverse experiences in patients aged 6 to 11 years of age which were reported by greater than 2% of patients treated with fexofenadine hydrochloride tablets at a dose of 30 mg twice daily in placebo controlled seasonal allergic rhinitis studies in the United States and Canada that were more common with fexofenadine hydrochloride than placebo.

Table 2
Adverse experiences reported in placebo-controlled seasonal allergic rhinitis studies in pediatric patients ages 6 to 11 in the United States and Canada at rates of greater than 2%

Adverse experience	*Fexofenadine 30 mg Twice daily n=269*	*Placebo n=273*
Headache	7.2%	6.6%
Accidental Injury	2.6%	1.8%
Coughing	3.8%	1.5%
Fever	2.4%	0.8%
Pain	2.4%	0.4%
Otitis Media	2.4%	0.0%
Upper Respiratory Tract Infection	4.8%	1.8%

Three clinical safety studies in 945 children aged 6 months to 5 years comparing 15 mg BID (n=85) and 30 mg BID (n=330) of an experimental formulation of fexofenadine to placebo (n=470) have been conducted. In general, fexofenadine hydrochloride was well tolerated in these studies. No unexpected adverse events were seen given the known safety profile of fexofenadine and likely adverse reactions for this patient population (see PRECAUTIONS, Pediatric Use). **Chronic Idiopathic Urticaria** Adverse events reported by patients 12 years of age and older in placebo-controlled chronic idiopathic urticaria studies were similar to those reported in placebo-controlled seasonal allergic rhinitis studies. In placebo-controlled chronic idiopathic urticaria clinical trials which included 726 patients 12 years of age and older receiving fexofenadine hydrochloride tablets at doses of 20 to 240 mg twice daily, adverse events were similar in fexofenadine hydrochloride and placebo-treated patients. Table 3 lists adverse experiences in patients aged 12 years and older which were reported by greater than 2% of patients treated with fexofenadine hydrochloride 60 mg tablets twice daily in controlled clinical studies in the United States and Canada and that were more common with fexofenadine hydrochloride than placebo. The safety of fexofenadine hydrochloride in the treatment of chronic idiopathic urticaria in pediatric patients 6 to 11 years of age is based on the safety profile of fexofenadine hydrochloride in adults and adolescent patients at doses equal to or higher than the recommended dose (see Pediatric Use).

Table 3
Adverse experiences reported in patients 12 years and older in placebo-controlled chronic idiopathic urticaria studies in the United States and Canada at rates of greater than 2%

Adverse experience	*Fexofenadine 60 mg Twice daily n=166*	*Placebo n=178*
Back Pain	2.6%	1.1%
Sinusitis	2.3%	1.1%
Dizziness	2.3%	0.6%
Drowsiness	2.3%	0.6%

Events that have been reported during controlled clinical trials (including seasonal allergic rhinitis and chronic idiopathic urticaria patients) with incidences less than 1% and similar to placebo and have been rarely reported during postmarketing surveillance include: insomnia, nervousness, and sleep disorders or paroniria. In rare cases, rash, urticaria, pruritus and hypersensitivity reactions (skin manifestations such as angioedema, chest tightness, dyspnea, flushing and systemic anaphylaxis) have been reported. **OVERDOSAGE** Reports of fexofenadine hydrochloride overdose have been infrequent and contain limited information. However, dizziness, drowsiness, and dry mouth have been reported. Single doses of fexofenadine hydrochloride up to 800 mg (six normal volunteers at this dose level) and doses up to 690 mg twice daily for 1 month (three normal volunteers at this dose level) or 240 mg once daily for 1 year (34 normal volunteers at this dose level) were administered without the development of clinically significant adverse events as compared to placebo. In the event of overdose, consider standard measures to remove any unabsorbed drug. Symptomatic and supportive treatment is recommended. Hemodialysis did not effectively remove fexofenadine hydrochloride from blood. The removal following terfenadine administration has not been studied. No deaths occurred in rats given oral doses of fexofenadine hydrochloride up to 5000 mg/kg (more than 110 times the maximum recommended daily oral dose in adults and 200 times the maximum recommended daily oral dose in children based on mg/m² and up to 2000 mg/kg in rats (25 times the maximum recommended daily oral dose in adults and 40 times the maximum recommended daily oral dose in children based on mg/m²). Additionally, no clinical signs of toxicity or gross pathological findings were observed in dogs given evidence of toxicity was observed at oral doses up to 2000 mg/kg (300 times the maximum recommended daily oral dose in adults and 500 times the maximum recommended daily oral dose in children based on mg/m²). **DOSAGE AND ADMINISTRATION Seasonal Allergic Rhinitis Adults and Children 12 Years and Older.** The recommended dose of ALLEGRA is 60 mg twice daily or 180 mg once daily. A dose of 30 mg once daily is recommended as the starting dose in patients with decreased renal function (see CLINICAL PHARMACOLOGY). **Children 6 to 11 Years.** The recommended dose of ALLEGRA is 30 mg twice daily. A dose of 30 mg once daily is recommended as the starting dose in pediatric patients with decreased renal function (see CLINICAL PHARMACOLOGY). **Chronic Idiopathic Urticaria Adults and Children 12 Years and Older.** The recommended dose of ALLEGRA is 60 mg twice daily. A dose of 60 mg once daily is recommended as the starting dose in patients with decreased renal function (see CLINICAL PHARMACOLOGY). **Children 6 to 11 Years.** The recommended dose of ALLEGRA is 30 mg twice daily. A dose of 30 mg once daily is recommended as the starting dose in pediatric patients with decreased renal function (see CLINICAL PHARMACOLOGY).

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Rev. May 2003a

Brief Summary

Aventis Pharmaceuticals Inc.

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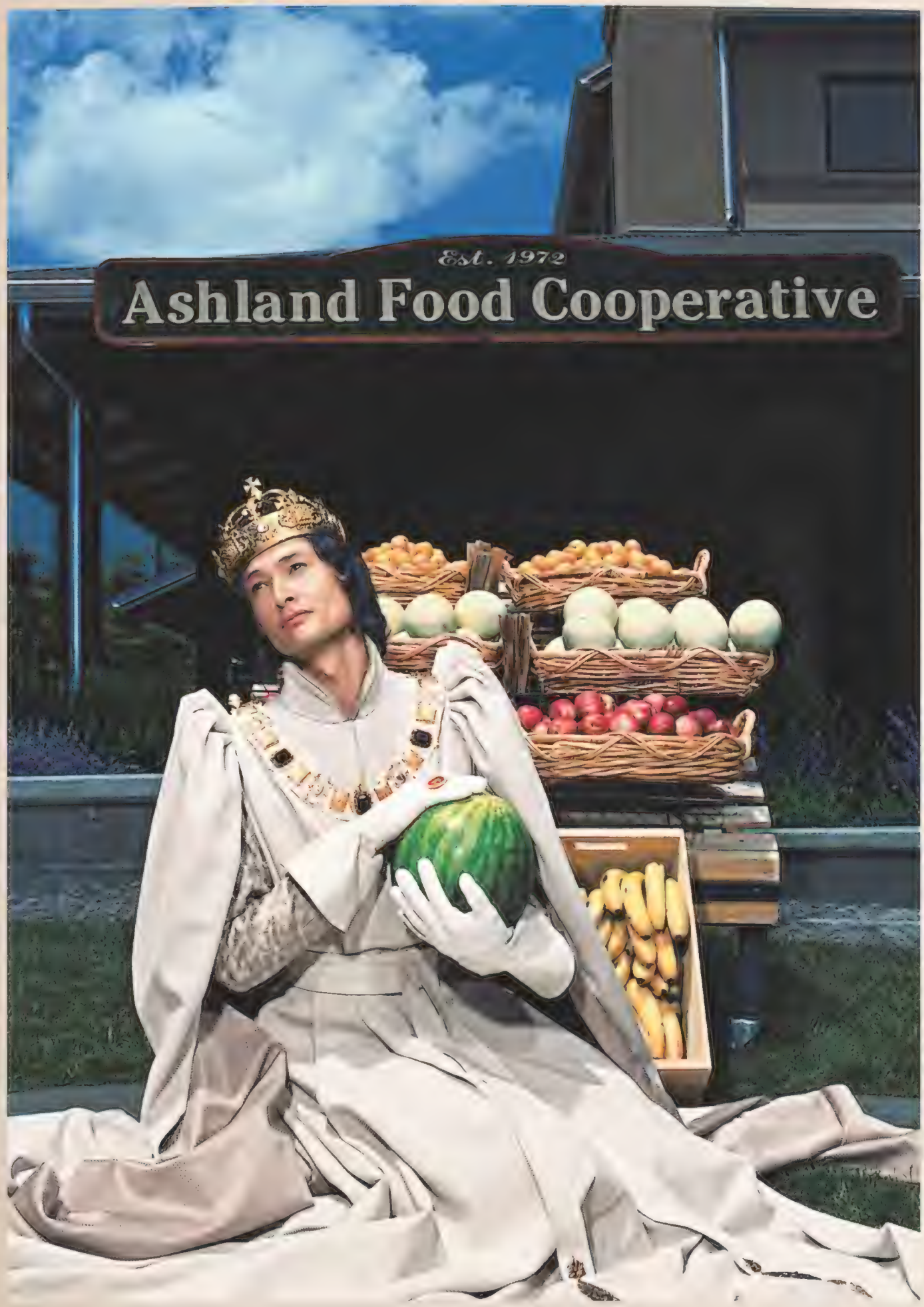
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"I don't so much write poetry as catch it," says Dave Densmore. "It's like a fever."

PATRICK S. DIXON; ELIZABETH WOLF

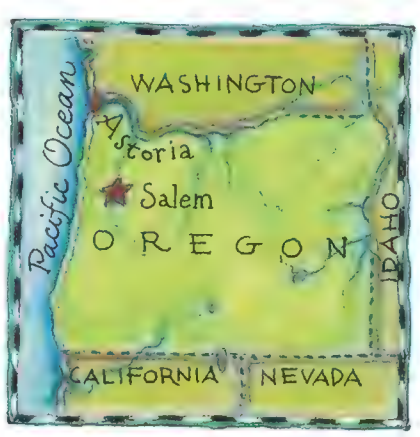
RHYME OR CUT BAIT

WHEN THESE FISHER POETS GATHER, NOBODY BRAGS ABOUT THE VERSE THAT GOT AWAY **BY SHARON BOORSTIN**

THE LAST WEEKEND in February is a slow time for Pacific Northwest and Alaska fishermen. The crab season is winding down, and the salmon aren't running yet. But in Astoria, Oregon, a historic fishing town on the Columbia River, there's real excitement as commercial fishermen gather to read or perform their poems, essays, doggerel and songs. Harrison "Smitty" Smith, a Harley rider and, at 79, the event's oldest poet, observes:

According to a fisherman
Whose name was Devine,
'The world's a cafeteria
You get one trip through the line.'

Playing to overflow crowds for three days and two nights at local art galleries, a bar, and a café, the eighth-annual Fisher Poets Gathering features more than 70 presenters, from Kodiak, Alaska, to Arcata, California. "We're a far-flung but tightknit community, so it's more of a reunion than a pretentious literary event," says Jon Broderick, a high-school English and French teacher, who heads up to Alaska with his four sons every summer to fish for salmon. Broderick, college professor Julie Brown and historian Hobe Kytr founded the conclave in 1998, taking inspiration from the annual National Cowboy Poetry Gathering in Elko, Nevada. "Just as in the cowboy life, the fisherman's life is given to long periods alone in which to contemplate his work, his life and the cosmos, so why should it come as any surprise that fishermen are deep?" Kytr says.



A rapt audience listens to Dave Densmore, a burly 59-year-old veteran fisherman with shoulder-length graying hair and hands indelibly stained with engine grease, as he reads

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an ode to his son, Skeeter. The boy died along with Densmore's father in a boating accident on Skeeter's 14th birthday, 20 years ago.

Several years later in Alaska,
Skeeter got his first big buck
He'd hunted and stalked it, hard, alone
Had nothing to do with luck.
Y'know I still watch that hillside
I guess I'm hoping for some luck
To see the ghost of my son
Stalking the ghost of that big buck.

John van Amerongen, the editor of the *Alaska Fisherman's Journal*, which has published fisher poetry for more than 20 years, says that the genre preceded written language and can be traced to a time "when fishermen battling the elements told their stories in rhyme because they were easier to remember." Since the 1960s, commercial fishing vessel radios have helped popularize fisher poetry. "Before then there was limited boat-to-boat communication," he says. "Now fishermen could while away long hours at sea when waiting for the fish to bite by sharing recipes, stories and poems."

Several of the fisher poets are women, who have made inroads in the male-dominated industry. "It's an old superstition that it's bad luck to have women on a boat," says van Amerongen. "But women have to be tough to overcome the raised eyebrows and the leers, in addition to doing their job on deck." Take pseudonymous "Moe Bowstern," 37, a Northwestern University English literature graduate who landed a job on a halibut boat in Kodiak, Alaska, in 1990. "My first task was to haul in a halibut as big as me," she recalls. "I'm straddling this huge fish—they can weigh 300 pounds—and it's bucking under me. I felt like I was on a bronco." Bowstern's duties have ranged from chopping and loading bait for crab pots to setting seine nets for salmon. She reads a blunt confessional:

"I arrived with a college degree, a smart mouth and a thirst for alcohol. I quit drinking cold turkey after that first summer. . . . I've replaced that demon alcohol with this fishing. Yes, it's dangerous, but. . . . More of my friends . . . are lost to alcohol and drugs and suicide and cancer than boat wrecks. And fishing is a lot more fun. . . . "

Pat Dixon became a regular at the Astoria reading after the Alaskan cannery he fished for closed five years ago. "When I discovered that many people were going through similar experiences," he says, "I realized I wasn't alone in my grief. I began to express how I felt in writing; in hearing others' stories and my own, I began to heal." Dixon's poem "Fat City in Four Directions" concludes:

We ride the ebb and swell of the job market,
negotiating interviews like we used to quarter
the boat through heavy weather.
we still run hard, looking for jumpers,
We still search for Fat City.

Geno Leech (top), Rachel Moore and Jon Broderick are known to fish and tell.

Later that Saturday night in the Voodoo Room, folks in the audience are asking one another, "Do you think Geno will show up?" Wesley "Geno" Leech, 55, who has worked as a merchant seaman and a commercial fisherman, is the dean of fisher poetry. But the previous night he was too sick with pneumonia to read. Then, suddenly, applause erupts, heads swivel, and the crowd parts to let Leech through. Wearing black sweat pants and a weathered Navy peacoat, he strides to the microphone in an entrance worthy of Elvis. Leech doesn't just recite his poetry; he closes his eyes and bellows each stanza, rocking back and forth as if on a rolling deck in high seas.

They're clingin' to the cross trees
Plastered to the mast
Splattered on the flyin' bridge
Bakin' on the stack. . . .
We're buckin' back to Naknek
Festooned with herring scales. . . .
If the Japanese eat herring roe
And the French escargot snails
How come there ain't a gourmet market
For all them herring scales?

On Sunday morning, the fisher poets and about a hundred of the 700 people who paid $10 each to hear them, jam the Astoria Visual Arts Gallery for an open-mike session. Smitty Smith, recovering from injuries he suffered when a truck rammed his Harley, limps to the microphone. "I had a lot of time thinking about coming back here and I sure wasn't disappointed," he says.

Joanna Reichhold, a 29-year-old woman who has been fishing off the coast of Cordova, Alaska, for five seasons, dedicates her last song—"My lover was a banjo picker, and I'm a picker of fish"—to Moe Bowstern. Bowstern waves the airplane ticket that will take her to Alaska this very night, where she's hopping on a boat to fish for crab in Marmot Bay.

By noon people are spilling out onto the sidewalk under an overcast sky. "The last several years I thought it was just us old guys making poems, but now the younger people are coming up," says co-founder Jon Broderick. "Smitty staggering up and pulling out a poem. Three or four generations of people telling their stories. I about teared up. I tell you, I felt like I was at a wedding."

SHARON BOORSTIN is the author of Cookin' for Love, *a novel with recipes. She lives in Los Angeles.*

PATRICK S. DIXON (3)

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YOUR BRANCH OR MINE?

FIREFLIES' COME-HITHER SIGNALS ARE BEING DECODED BY PENLIGHT-WIELDING BIOLOGISTS, WHO'VE FOUND TREACHERY, ALSO, IN THE SUMMER-NIGHT FLASHES **BY JESSICA GORMAN**

SARA LEWIS is impersonating a firefly. She stands in waist-deep grass and brush, the hood of her jacket pulled tight around her ears to ward off mosquitoes, and clicks her penlight into the darkness. Frogs chirp. A dog barks. Lewis clicks again. Still nothing. She turns and flashes it in another direction. Off in the tall grass, a lone firefly lights up. Then another. Lewis has convinced the bugs that she too is a firefly, and they are flirting with her.

Lewis wanders toward one of the flashers and locates a female on the tip of a tall blade of grass. Nearby, a male hovers, interested. The male flashes, waits, and the female flashes back. "It's just like talking on the telephone," says Lewis.

Their libidinous flashes call out, "Hey, glitter bug. Why don't you come over and see me?" That's one reason why Lewis and other biologists love fireflies: the flashes literally shed light on how the insects communicate, mate, reproduce and pass along their genes to the next generation. More than just glittery magic on a summer evening, firefly flashes are part of a fierce competition for evolutionary survival.

During firefly season, Lewis and her students spend nearly every night at this dark field just west of Boston. They spy on courting fireflies and catch some to study in their entomology lab at Tufts University at Medford-Somerville.

Most of the fireflies that Lewis studies—like those chased down by children in backyards throughout the eastern United States—belong to the genus *Photinus*. They live underground as larvae for about two years before emerging for a two-week, flat-out sprint through adulthood. They spend their adult lives courting and mating—they don't even stop to eat. "They're very single-minded," Lewis says.

Around 2,000 species of fireflies—which are not flies at all, but beetles—have been identified worldwide, and scientists are still finding new species. (Fireflies west of the Rocky Mountains do not flash. They emit chemicals called pheromones to elicit a potential mate's interest.) In the eastern United States, fireflies from three genera—*Photinus*, *Photuris* and *Pyractomena*—punctuate the dusk each summer with a billion bursts of yellow, orange or green light.

A *Photinus* firefly's light organ, called a lantern, is in its abdomen. In males, two segments of the abdomen light up, and in females, just part of one. A firefly flips its light on when two chemicals—the devilishly named luciferin and luciferase—react inside the lantern in the presence of oxygen. Telling one species from another is difficult. In her lab, Lewis pulls out a box containing about a dozen species of pinned fireflies that look pretty much the same. Species identification depends partly on minute distinctions in male genitalia and partly on differences in flash behavior.

Making the most of its two-week adult life, a male *Photinus* fly signals its intentions to females.

E. R. DEGGINGER / PHOTO RESEARCHERS

Every firefly species that flashes produces a unique pattern while courting. Males of some taciturn species flash just once; other kinds of males blink twice or several times. Males fly around advertising their identity to females in the grass below. A female recognizes her species' code and flashes back if she wants to mate. Still, even within a species, not all male flashes are exactly alike, and biologists are eager to learn more about what attracts a female to one flash more than another.

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Not all fireflies are out hunting mates. Some are just hunting.

evening, there's still so much that we don't know about fireflies," says Marc Branham, an entomologist at the University of Florida in Gainesville. He and Michael Greenfield, of the University of Kansas at Lawrence, deciphered the code of fireflies called *Photinus consimilis,* which range from the Ozarks to northern Florida. They emit several flashes in succession. Rapid flashers attract the most female attention, the researchers found. When a female likes a male's flash, she responds with more flashes, and her flashes are brighter.

Other males advertise their intentions succinctly. Male *Photinus ignitus* fireflies, for example, found from Maine to North Carolina, employ just a single flash. Could that lone burst of light somehow be sexy or not sexy?

When fireflies mate (above left), the male bestows a "nuptial gift" (inset). Biologist Sara Lewis (right, near Boston) says "they're very single-minded."

Five years ago, Lewis and then-student Christopher Cratsley discovered that variations in the single flashes of *Photinus ignitus* do say something about a male's suitability. Males with longer flashes—which females prefer—were more generous with what biologists call their "nuptial gift," a coiled package of sperm and protein. During copulation, the male deposits the gift in the female's reproductive tract, where it provides nourishment for the female and her developing eggs. By controlling fireflies' access to one another in the lab, Lewis and another former student, Jennifer Rooney, demonstrated that a female who receives more nuptial gifts produces more offspring.

As researchers learn more firefly secrets, they've found similarities to animals such as frogs and insects that vocalize their sexual pleas. "Females in many groups seem to prefer higher-energy courtship signals," says Lewis. In fireflies, females are wowed by faster or longer flashes; in some frogs, crickets and katydids, females like longer, louder or faster calls. In other words, a female wants a mate who works hard to get her attention. Such devotion could be a sign that he has good genes or can provide well for her.

Not all flashing fireflies are hunting mates. Some are just hunting. James Lloyd, a firefly expert recently retired from the University of Florida in Gainesville, discovered that female *Photuris* fireflies mimic female *Photinus* fireflies. When an unsuspecting male *Photinus* is drawn to the flashing in the grass, she eats him. This behavior, called aggressive mimicry, isn't unusual in the animal kingdom, says Lewis. Bolas spiders emit an odor similar to a female moth's to attract male moths as prey. And certain coral reef fish imitate wrasses, which clean other fish's scales, to get near other fish and take a bite out of them. But *Photuris* females, nicknamed femmes fatales, are masters of disguise: they can mimic the female response signals of whatever firefly prey is nearby.

Fireflies live dangerous, showy lives, and are easy prey for bats and spiders, as well as other fireflies. For protection, many species produce bitter-tasting chemicals, such as varieties of a compound called lucibufagin. Predatory *Photuris* seldom devour *Pyractomena* fireflies, for instance, possibly deterred by their awful flavor. *Photinus* also produce chemical deterrents, but theirs don't work against *Photuris* females. In fact, *Photuris* females may even benefit, retooling the bitter chemicals they eat to bolster their own defenses.

One night near the end of firefly season, Lewis was disappointed that she no longer saw any predatory *Photuris*. She turned her attention toward the grass, where a pair of *Photinus* had been flirting intently, but the male had left without mating. People often think of males as being perpetually ready to mate, says Lewis, and think of females as picky. At the beginning of the firefly season, that's largely true. But toward the end, fewer *Photinus* males are left, and they've used up their limited resources mating with successive partners, while females gained nourishment in the exchanges. If a male thinks a female doesn't have many eggs left, he'll take his precious nuptial gift elsewhere.

Looking at the abandoned female, I take an amateur stab at a penlight flash. To my amazement, the *Photinus* lights up, hopeful. Lewis isn't surprised. "She's pretty desperate at this point in the season," she says.

JESSICA GORMAN is a science writer and editor who is based in Philadelphia.

DAN L. PERLMAN (2); TUFTS UNIVERSITY

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JUST DUCKY In April, the U.S. Department of the Treasury, often passed over in favor of its more popular neighbor, the White House, became a tourist hot spot. "There's a steady stream from morning till evening," said Treasury spokesman Robert Nichols. The draw? A brown mallard duck and the 11 eggs she was sitting on. Known variously as T-bill, Quacks Reform and Duck Cheney, the wild duck settled under an American elm tree near the building's main entrance, where she was provided with a water bowl and protective fencing. On April 30, all 11 ducklings hatched. The next day the dusky dozen were whisked by motorcade to nearby Rock Creek Park and released.

–HELEN STARKWEATHER

SUSAN WALSH / AP / WIDE WORLD PHOTOS

A FORK IN THE RIVER

AFTER DELIBERATING FOR NINE DAYS, THE CAPTAINS CHOOSE THE TORTUOUS SOUTHWEST BRANCH OF THE MISSOURI TOWARD THE GREAT FALLS

BY JUNE 1, 1805, *the two expedition leaders, relying on information gathered from the Hidatsa Indians, estimated that the corps should be nearing the Great Falls in present-day Montana. Instead, they encountered an unexpected fork in the river, which the Hidatsa had neglected to mention.*

June 3, 1805 [Capt. Meriwether Lewis]
This morning early we passed over and formed a camp on the point formed by the junction of the two large rivers. . . . An interesting question was now to be determined; which of these rivers was the Missouri, or that river which the [Hidatsa] call . . . Missouri, and which they had discribed to us as approaching very near to the Columbia river. [To] mistake the stream at this period of the season, two months of the traveling season having now elapsed, and to ascend such stream to the rocky Mountain or perhaps much further before we could inform ourselves whether it did approach the Columbia or not, and then be obliged to return and take the other stream would not only loose us the whole of the season but would probably so dishearten the party that it might defeat the expedition altogether. . . . an investigation of both streams was the first thing to be done. . . . accordingly we dispatched two light canoes with three men in each up those streams.

June 8 [Sgt. Patrick Gass]
About 4 in the afternoon Captain Lewis and his party came to camp. They had been up the North branch about 60 miles, and found it navigable that distance; not so full of islands as the other branch and a greater quantity of timber near it and plenty of game, which is not the case on the South branch. . . . The officers concluded that the south branch was the most proper to ascend, which they think is the Missouri. The other they called Maria's river.

June 9 [Lewis]
I indevoured to impress on the minds of the party all of whom except Capt. C. being still firm in the beleif that the N. Fork was the Missouri and that which we ought to take; they said very cheerfully that they were ready to follow us any wher we thought proper to direct but that they still thought that the other was the river and that they were affraid that the South fork would soon termineate in the mountains and leave us at a great distance from the Columbia.

On June 13, the expedition finally reached the Great Falls. Impossible to navigate, the 87-foot-high cataracts would force the explorers to carry their boats and supplies overland. Contrary to the Hidatsa's estimate of a half day for the overland trek, the nearly 17-mile portage would actually take 11 days.

"The men has to haul with all their Strength. . . . but . . . all go Chearfully on."

FRANK D. HAGEL

June 16 [Lewis]
I now informed Capt. C. of my discoveries with rispect to the most proper side for our portage, and of it's great length, which I could not estimate at less than 16 miles. . . . good or bad we must make the portage.

June 23 [Lewis]
[While portaging around the Great Falls, the men] are obliged to halt and rest frequently for a few minutes, at every halt these poor fellows tumble down and are so much fortiegued that many of them are asleep in an instant; in short their fatiegues are incredible; some are limping from the soreness of their feet, others faint and unable to stand for a few minutes, with heat and fatiegue, yet no one complains, all go with cheerfullness.

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Please see additional important product information on next page.

[1] IMS MAT/December/04 (MPFARI December/04 database).

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Syncopal episodes have been reported in association with the use of ARICEPT®. ***Gastrointestinal Conditions:*** Through their primary action, cholinesterase inhibitors may be expected to increase gastric acid secretion due to increased cholinergic activity. Therefore, patients should be monitored closely for symptoms of active or occult gastrointestinal bleeding, especially those at increased risk for developing ulcers, e.g., those with a history of ulcer disease or those receiving concurrent nonsteroidal anti-inflammatory drugs (NSAIDS). Clinical studies of ARICEPT® have shown no increase relative to placebo, in the incidence of either peptic ulcer disease or gastrointestinal bleeding. ARICEPT®, as a predictable consequence of its pharmacological properties, has been shown to produce diarrhea, nausea and vomiting. These effects, when they occur, appear more frequently with the 10 mg/day dose than with the 5 mg/day dose. In most cases, these effects have been mild and transient, sometimes lasting one to three weeks, and have resolved during continued use of ARICEPT®. ***Genitourinary:*** Although not observed in clinical trials of ARICEPT®, cholinomimetics may cause bladder outflow obstruction. ***Neurological Conditions:*** Seizures: Cholinomimetics are believed to have some potential to cause generalized convulsions. However, seizure activity also may be a manifestation of Alzheimer's Disease. ***Pulmonary Conditions:*** Because of their cholinomimetic actions, cholinesterase inhibitors should be prescribed with care to patients with a history of asthma or obstructive pulmonary disease. **PRECAUTIONS Drug-Drug Interactions** (see Clinical Pharmacology: Clinical Pharmacokinetics: Drug-drug Interactions) ***Effect of ARICEPT® on the Metabolism of Other Drugs:*** No *in vivo* clinical trials have investigated the effect of ARICEPT® on the clearance of drugs metabolized by CYP 3A4 (e.g. cisapride, terfenadine) or by CYP 2D6 (e.g. imipramine). However, *in vitro* studies show a low rate of binding to these enzymes (mean K_i about 50-130 μM), that, given the therapeutic plasma concentrations of donepezil (164 nM), indicates little likelihood of interference. Whether ARICEPT® has any potential for enzyme induction is not known. Formal pharmacokinetic studies evaluated the potential of ARICEPT® for interaction with theophylline, cimetidine, warfarin, digoxin and ketoconazole. No effects of ARICEPT® on the pharmacokinetics of these drugs were observed. ***Effect of Other Drugs on the Metabolism of ARICEPT®:*** Ketoconazole and quinidine, inhibitors of CYP450, 3A4 and 2D6, respectively, inhibit donepezil metabolism *in vitro*. Whether there is a clinical effect of quinidine is not known. In a 7-day crossover study in 18 healthy volunteers, ketoconazole (200 mg q.d.) increased mean donepezil (5 mg q.d.) concentrations (AUC_{0-24} and C_{max}) by 36%. The clinical relevance of this increase in concentration is unknown. Inducers of CYP 2D6 and CYP 3A4 (e.g., phenytoin, carbamazepine, dexamethasone, rifampin, and phenobarbital) could increase the rate of elimination of ARICEPT®. Formal pharmacokinetic studies demonstrated that the metabolism of ARICEPT® is not significantly affected by concurrent administration of digoxin or cimetidine. ***Use with Anticholinergics:*** Because of their mechanism of action, cholinesterase inhibitors have the potential to interfere with the activity of anticholinergic medications. ***Use with Cholinomimetics and Other Cholinesterase Inhibitors:*** A synergistic effect may be expected when cholinesterase inhibitors are given concurrently with succinylcholine, similar neuromuscular blocking agents or cholinergic agonists such as bethanechol. **Carcinogenesis, Mutagenesis, Impairment of Fertility** No evidence of a carcinogenic potential was detected in an 88-week carcinogenicity study of donepezil hydrochloride conducted in CD-1 mice at doses up to 180 mg/kg/day (approximately 90 times the maximum recommended human dose on a mg/m² basis), or in a 104-week carcinogenicity study in Sprague-Dawley rats at doses up to 30 mg/kg/day (approximately 30 times the maximum recommended human dose on a mg/m² basis). Donepezil was not mutagenic in the Ames reverse mutation assay in bacteria, or in a mouse lymphoma forward mutation assay *in vitro*. In the chromosome aberration test in cultures of Chinese hamster lung (CHL) cells, some clastogenic effects were observed. Donepezil was not clastogenic in the *in vivo* mouse micronucleus test and was not genotoxic in an *in vivo* unscheduled DNA synthesis assay in rats. Donepezil had no effect on fertility in rats at doses up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis). **Pregnancy** ***Pregnancy Category C:*** Teratology studies conducted in pregnant rats at doses up to 16 mg/kg/day (approximately 13 times the maximum recommended human dose on a mg/m² basis) and in pregnant rabbits at doses up to 10 mg/kg/day (approximately 16 times the maximum recommended human dose on a mg/m² basis) did not disclose any evidence for a teratogenic potential of donepezil. However, in a study in which pregnant rats were given up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis) from day 17 of gestation through day 20 postpartum, there was a slight increase in stillbirths and a slight decrease in pup survival through day 4 postpartum at this dose; the next lower dose tested was 3 mg/kg/day. There are no adequate or well-controlled studies in pregnant women. ARICEPT® should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. **Nursing Mothers** It is not known whether donepezil is excreted in human breast milk. ARICEPT® has no indication for use in nursing mothers. **Pediatric Use** There are no adequate and well-controlled trials to document the safety and efficacy of ARICEPT® in any illness occurring in children. **Geriatric Use** Alzheimer's disease is a disorder occurring primarily in individuals over 55 years of age. The mean age of the patients enrolled in the clinical studies with ARICEPT® was 73 years; 80% of these patients were between 65 and 84 years old and 49% of the patients were at or above the age of 75. The efficacy and safety data presented in the clinical trials section were obtained from these patients. There were no clinically significant differences in most adverse events reported by patient groups ≥65 years old and <65 years old. **ADVERSE REACTIONS Adverse Events Leading to Discontinuation** The rates of discontinuation from controlled clinical trials of ARICEPT® due to adverse events for the ARICEPT® 5 mg/day treatment groups were comparable to those of placebo-treatment groups at approximately 5%. The rate of discontinuation of patients who received 7-day escalations from 5 mg/day to 10 mg/day, was higher at 13%. The most common adverse events leading to discontinuation, defined as those occurring in at least 2% of patients and at twice the incidence seen in placebo patients, are shown in Table 1.

Table 1. Most Frequent Adverse Events Leading to Withdrawal from Controlled Clinical Trials by Dose Group

Dose Group	Placebo	5 mg/day ARICEPT®	10 mg/day ARICEPT®
Patients Randomized Event/% Discontinuing	355	350	315
Nausea	1%	1%	3%
Diarrhea	0%	<1%	3%
Vomiting	<1%	<1%	2%

Most Frequent Adverse Clinical Events Seen in Association with the Use of ARICEPT® The most common adverse events, defined as those occurring at a frequency of at least 5% in patients receiving 10 mg/day and twice the placebo rate, are largely predicted by ARICEPT®'s cholinomimetic effects. These include nausea, diarrhea, insomnia, vomiting, muscle cramp, fatigue and anorexia. These adverse events were often of mild intensity and transient, resolving during continued ARICEPT® treatment without the need for dose modification. There is evidence to suggest that the frequency of these common adverse events may be affected by the rate of titration. An open-label study was conducted with 269 patients who received placebo in the 15 and 30-week studies. These patients were titrated to a dose of 10 mg/day over a 6-week period. The rates of common adverse events were lower than those seen in patients titrated to 10 mg/day over one week in the controlled clinical trials and were comparable to those seen in patients on 5 mg/day. See Table 2 for a comparison of the most common adverse events following one and six week titration regimens.

Table 2. Comparison of Rates of Adverse Events in Patients Titrated to 10 mg/day Over 1 and 6 Weeks

	No titration		One week titration	Six week titration
Adverse Event	**Placebo (n=315)**	**5 mg/day (n=311)**	**10 mg/day (n=315)**	**10 mg/day (n=269)**
Nausea	6%	5%	19%	6%
Diarrhea	5%	8%	15%	9%
Insomnia	6%	6%	14%	6%
Fatigue	3%	4%	8%	3%
Vomiting	3%	3%	8%	5%
Muscle cramps	2%	6%	8%	3%
Anorexia	2%	3%	7%	3%

Adverse Events Reported in Controlled Trials The events cited reflect experience gained under closely monitored conditions of clinical trials in a highly selected patient population. In actual clinical practice or in other clinical trials, these frequency estimates may not apply, as the conditions of use, reporting behavior, and the kinds of patients treated may differ. Table 3 lists treatment emergent signs and symptoms that were reported in at least 2% of patients in placebo-controlled trials who received ARICEPT® and for which the rate of occurrence was greater for ARICEPT® assigned than placebo assigned patients. In general, adverse events occurred more frequently in female patients and with advancing age.

Table 3. Adverse Events Reported in Controlled Clinical Trials in at Least 2% of Patients Receiving ARICEPT® and at a Higher Frequency than Placebo-treated Patients

Body System/Adverse Event	Placebo (n=355)	ARICEPT® (n=747)
Percent of Patients with any Adverse Event	**72**	**74**
Body as a Whole		
Headache	9	10
Pain, various locations	8	9
Accident	6	7
Fatigue	3	5
Cardiovascular System		
Syncope	1	2
Digestive System		
Nausea	6	11
Diarrhea	5	10
Vomiting	3	5
Anorexia	2	4
Hemic and Lymphatic System		
Ecchymosis	3	4
Metabolic and Nutritional Systems		
Weight Decrease	1	3
Musculoskeletal System		
Muscle Cramps	2	6
Arthritis	1	2
Nervous System		
Insomnia	6	9
Dizziness	6	8
Depression	<1	3
Abnormal Dreams	0	3
Somnolence	<1	2
Urogenital System		
Frequent Urination	1	2

Other Adverse Events Observed During Clinical Trials ARICEPT® has been administered to over 1700 individuals during clinical trials worldwide. Approximately 1200 of these patients have been treated for at least 3 months and more than 1000 patients have been treated for at least 6 months. Controlled and uncontrolled trials in the United States included approximately 900 patients. In regards to the highest dose of 10 mg/day, this population includes 650 patients treated for 3 months, 475 patients treated for 6 months and 116 patients treated for over 1 year. The range of patient exposure is from 1 to 1214 days. Treatment emergent signs and symptoms that occurred during 3 controlled clinical trials and two open-label trials in the United States were recorded as adverse events by the clinical investigators using terminology of their own choosing. To provide an overall estimate of the proportion of individuals having similar types of events, the events were grouped into a smaller number of standardized categories using a modified COSTART dictionary and event frequencies were calculated across all studies. These categories are used in the listing below. The frequencies represent the proportion of 900 patients from these trials who experienced that event while receiving ARICEPT®. All adverse events occurring at least twice are included, except for those already listed in Tables 2 or 3, COSTART terms too general to be informative, or events less likely to be drug caused. Events are classified by body system and listed using the following definitions: *frequent adverse events*—those occurring in at least 1/100 patients; *infrequent adverse events*—those occurring in 1/100 to 1/1000 patients. These adverse events are not necessarily related to ARICEPT® treatment and in most cases were observed at a similar frequency in placebo-treated patients in the controlled studies. No important additional adverse events were seen in studies conducted outside the United States. **Body as a Whole:** *Frequent:* influenza, chest pain, toothache; *Infrequent:* fever, edema face, periorbital edema, hernia niatal, abscess, cellulitis, chills, generalized coldness, head fullness, listlessness. **Cardiovascular System:** *Frequent:* hypertension, vasodilation, atrial fibrillation, hot flashes, hypotension; *Infrequent:* angina pectoris, postural hypotension, myocardial infarction, AV block (first degree), congestive heart failure, arteritis, bradycardia, peripheral vascular disease, supraventricular tachycardia, deep vein thrombosis. **Digestive System:** *Frequent:* fecal incontinence, gastrointestinal bleeding, bloating, epigastric pain; *Infrequent:* eructation, gingivitis, increased appetite, flatulence, periodontal abscess, cholelithiasis, diverticulitis, drooling, dry mouth, fever sore, gastritis, irritable colon, tongue edema, epigastric distress, gastroenteritis, increased transaminases, hemorrhoids, ileus, increased thirst, jaundice, melena, polydipsia, duodenal ulcer, stomach ulcer. **Endocrine System:** *Infrequent:* diabetes mellitus, goiter. **Hemic and Lymphatic System:** *Infrequent:* anemia, thrombocythemia, thrombocytopenia, eosinophilia, erythrocytopenia. **Metabolic and Nutritional Disorders:** *Frequent:* dehydration; *Infrequent:* gout, hypokalemia, increased creatine kinase, hyperglycemia, weight increase, increased lactate dehydrogenase. **Musculoskeletal System:** *Frequent:* bone fracture; *Infrequent:* muscle weakness, muscle fasciculation. **Nervous System:** *Frequent:* delusions, tremor, irritability, paresthesia, aggression, vertigo, ataxia, increased libido, restlessness, abnormal crying, nervousness, aphasia; *Infrequent:* cerebrovascular accident, intracranial hemorrhage, transient ischemic attack, emotional lability, neuralgia, coloness (localized), muscle spasm, dysphoria, gait abnormality, hypertonia, hypokinesia, neurodermatitis, numbness (localized) paranoia, dysarthria, dysphasia, hostility, decreased libido, melancholia, emotional withdrawal, nystagmus, pacing. **Respiratory System:** *Frequent:* dyspnea, sore throat, bronchitis; *Infrequent:* epistaxis, postnasal drip, pneumonia, hyperventilation, pulmonary congestion, wheezing, hypoxia, pharyngitis, pleurisy, pulmonary collapse, sleep apnea, snoring. **Skin and Appendages:** *Frequent:* pruritus, diaphoresis, urticaria; *Infrequent:* dermatitis, erythema, skin discoloration, hyperkeratosis, alopecia, fungal dermatitis, herpes zoster, hirsutism, skin striae, night sweats, skin ulcer. **Special Senses:** *Frequent:* cataract, eye irritation, vision blurred; *Infrequent:* dry eyes, glaucoma, earache, tinnitus, blepharitis, decreased hearing, retinal hemorrhage, otitis externa, otitis media, bad taste, conjunctival hemorrhage, ear buzzing, motion sickness, spots before eyes. **Urogenital System:** *Frequent:* urinary incontinence, nocturia; *Infrequent:* dysuria, hematuria, urinary urgency, metrorrhagia, cystitis, enuresis, prostate hypertrophy, pyelonephritis, inability to empty bladder, breast fibroadenosis, fibrocystic breast, mastitis, pyuria, renal failure, vaginitis. **Postintroduction Reports** Voluntary reports of adverse events temporally associated with ARICEPT® that have been received since market introduction that are not listed above, and that there is inadequate data to determine the causal relationship with the drug include the following: abdominal pain, agitation, cholecystitis, confusion, convulsions, hallucinations, heart block (all types), hemolytic anemia, hepatitis, hyponatremia, neuroleptic malignant syndrome, pancreatitis, and rash. **OVERDOSAGE Because strategies for the management of overdose are continually evolving, it is advisable to contact a Poison Control Center to determine the latest recommendations for the management of an overdose of any drug.** As in any case of overdose, general supportive measures should be utilized. Overdosage with cholinesterase inhibitors can result in cholinergic crisis characterized by severe nausea, vomiting, salivation, sweating, bradycardia, hypotension, respiratory depression, collapse and convulsions. Increasing muscle weakness is a possibility and may result in death if respiratory muscles are involved. Tertiary anticholinergics such as atropine may be used as an antidote for ARICEPT® overdosage. Intravenous atropine sulfate titrated to effect is recommended: an initial dose of 1.0 to 2.0 mg IV with subsequent doses based upon clinical response. Atypical responses in blood pressure and heart rate have been reported with other cholinomimetics when co-administered with quaternary anticholinergics such as glycopyrrolate. It is not known whether ARICEPT® and/or its metabolites can be removed by dialysis (hemodialysis, peritoneal dialysis, or hemofiltration). Dose-related signs of toxicity in animals included reduced spontaneous movement, prone position, staggering gait, lacrimation, clonic convulsions, depressed respiration, salivation, miosis, tremors, fasciculation and lower body surface temperature. **DOSAGE AND ADMINISTRATION** The dosages of ARICEPT® shown to be effective in controlled clinical trials are 5 mg and 10 mg administered once per day. The higher dose of 10 mg did not provide a statistically significantly greater clinical benefit than 5 mg. There is a suggestion, however, based upon order of group mean scores and dose trend analyses of data from these clinical trials, that a daily dose of 10 mg of ARICEPT® might provide additional benefit for some patients. Accordingly, whether or not to employ a dose of 10 mg is a matter of prescriber and patient preference. Evidence from the controlled trials indicates that the 10 mg dose, with a one week titration, is likely to be associated with a higher incidence of cholinergic adverse events than the 5 mg dose. In open-label trials using a 6 week titration, the frequency of these same adverse events was similar between the 5 mg and 10 mg dose groups. Therefore, because steady state is not achieved for 15 days and because the incidence of untoward effects may be influenced by the rate of dose escalation, treatment with a dose of 10 mg should not be contemplated until patients have been on a daily dose of 5 mg for 4 to 6 weeks. ARICEPT® should be taken in the evening, just prior to retiring. ARICEPT® can be taken with or without food. **HOW SUPPLIED** ARICEPT® is supplied as film-coated, round tablets containing either 5 mg or 10 mg of donepezil hydrochloride. The 5 mg tablets are white. The strength, in mg (5), is debossed on one side and ARICEPT is debossed on the other side. The 10 mg tablets are yellow. The strength, in mg (10), is debossed on one side and ARICEPT is debossed on the other side. 5 mg (White): Bottles of 30 (NDC# 62856-245-30) Bottles of 90 (NDC# 62856-245-90), Unit Dose Blister Package 100 (10x10) (NDC# 62856-245-41). 10 mg (Yellow): Bottles of 30 (NDC# 62856-246-30), Bottles of 90 (NDC# 62856-246-90), Unit Dose Blister Package 100 (10x10) (NDC# 62856-246-41). **Storage:** Store at controlled room temperature, 15°C to 30°C (59°F to 86°F).

℞ only.

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Teaneck, NJ 07666

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NEUROSCIENCE
Pfizer U.S. Pharmaceuticals
New York, NY 10017

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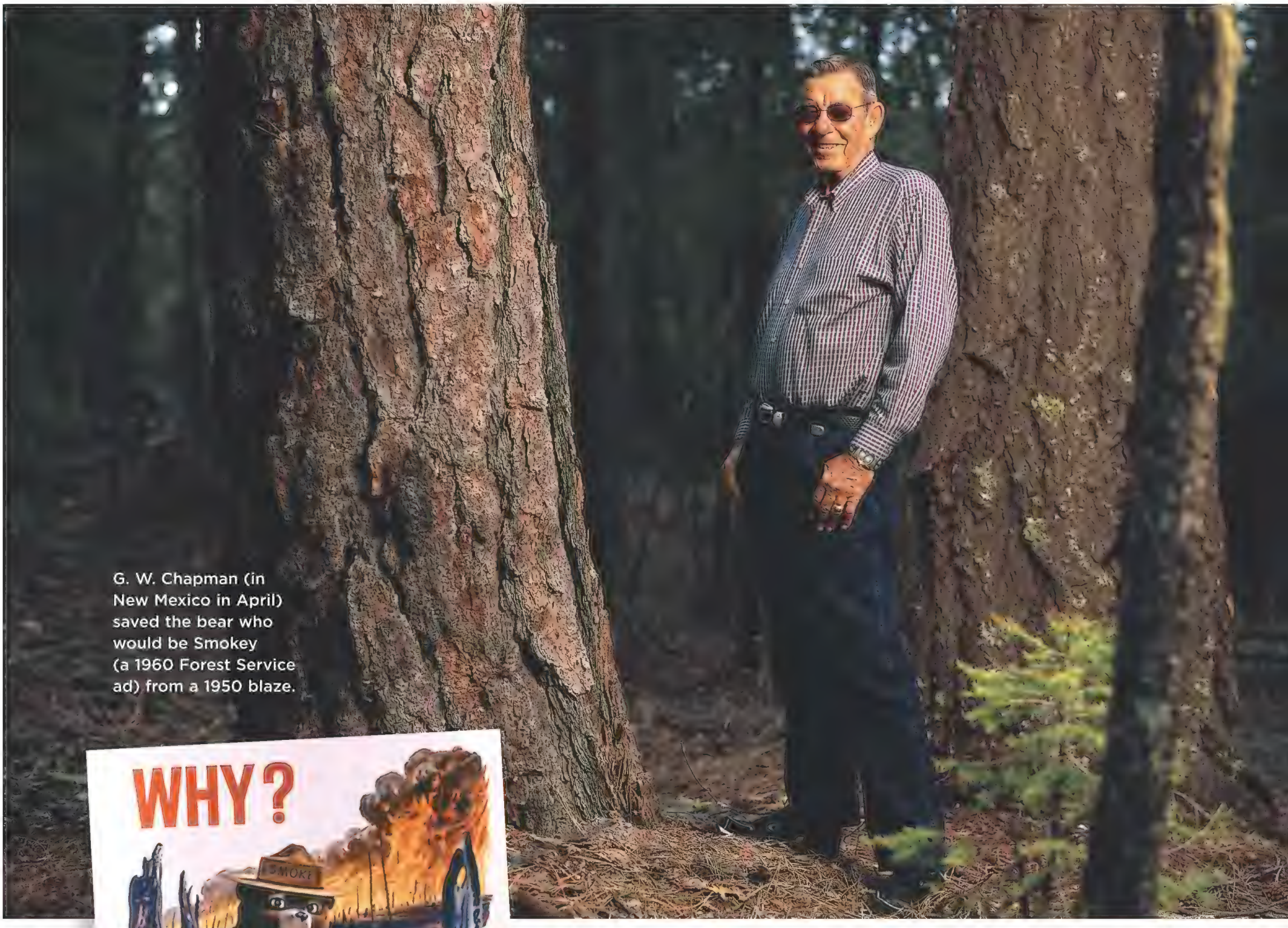

G. W. Chapman (in New Mexico in April) saved the bear who would be Smokey (a 1960 Forest Service ad) from a 1950 blaze.

DOUGLAS MERRIAM; USDA / AP / WIDE WORLD PHOTOS

A BEAR-HANDED GRAB

HOW A STRANDED CUB BECAME THE LIVING SYMBOL FOR ONE OF AMERICA'S BEST-KNOWN ADVERTISING CAMPAIGNS

G. W. CHAPMAN plucked America's most famous bear from a forest fire near Capitan, New Mexico. It was May 1950, and Chapman was a 20-year-old U.S. Forest Service rookie fighting the biggest blaze he'd ever seen. Dry winds whipped a firestorm toward him and his crew, and they lay flat on a rockslide while flames crowned in the treetops. "When it was all over, we heard this little strange noise," Chapman recalls. "And here was this bear cub up in a burned tree." They called the cinnamon-

colored creature—badly singed, but still breathing—Hotfoot Teddy.

Chapman wrapped the 3-month-old cub in his Army field jacket and carried him to base camp, along the way glimpsing corpses of deer and bears "that weren't so lucky making it out," he says. A game warden flew Hotfoot to Santa Fe for treatment and cared for him at home. Within weeks, the growing bear was bullying the family dog and overturning furniture. Eventually, the director of the New Mexico Department of Game and Fish offered the animal to the Forest Service, which promptly adopted the cub and outfitted him with a stage name: Smokey.

Actually, the agency, which celebrates its centennial this year and will participate in this summer's Folklife Festival on the National Mall, had debuted a cartoon black bear named Smokey in 1944. Sporting a forester's hat and bluejeans, the bear cautioned, "Only you can prevent forest fires." (In 2001, forestry officials changed the slogan to "Only you can prevent wildfires," while underscoring the growing awareness that some natural fires benefit forests.)

The safety campaign's first living symbol took up residence at the Smithsonian's National Zoo in June 1950. When he arrived, "children screamed with delight and photographers flashed scores of bulbs," the *Washington Post* reported. The press couldn't get enough of the ursine celebrity. In 1962 the Zoo brought him a "wife," as the *Post* persisted in calling her, named Goldie, who was "a blond from New Mexico," the *Los Angeles Times* noted. Over the next decade, Smokey, in "monklike abstinence," hadn't "so much as given his bride a second look, except when she tries to take too much fish," Kenneth Turan wrote in the *Post*, and the pair never mated.

Smokey was "fat and sassy," said black-hatted William Boyd, a.k.a. Hopalong Cassidy, after the two met in 1950.

Smokey received more than four million visitors a year. He got so much fan mail that the Postal Service gave him a separate ZIP code. A 1968 survey found that kids liked the cartoon cub more than Bullwinkle. Smokey died, heirless, in 1976 to a chorus of obituaries.

As for Chapman, he used the $300 bonus he'd earned working the 1950 Capitan blaze to get married. He later launched a civil service Air Force career. Now retired in Alamogordo, New Mexico, he's scheduled to come to the Folklife Festival and talk about his run-in with Smokey.

A small yellow sign emblazoned with a black bear's head hangs on the front of Chapman's Ford pickup. People ask him about it. Sometimes he spills the whole story. Sometimes he just says, "Oh, I like bears."

—ANNE BROACHE

WHO'S COUNTING?

$7.30

A POUND IS THE GOING RATE FOR HIGH-QUALITY FRANKINCENSE IN OMAN, A LEADING PRODUCER OF THE AROMATIC GUM RESIN AND A PARTICIPANT IN THIS SUMMER'S SMITHSONIAN FOLKLIFE FESTIVAL. OMAN, A NATION OF 2.3 MILLION ON THE ARABIAN PENINSULA, IS THE FIRST ARAB STATE TO TAKE PART IN THE ANNUAL EVENT. THE RAW MATERIAL FOR FRANKINCENSE (INSET) SEEPS FROM CUTS IN THE *BOSWELLIA SACRA* TREE (LEFT), WHICH GROWS IN SOUTHERN OMAN. PERHAPS BEST KNOWN TO WESTERNERS AS A GIFT OF THE BIBLE'S WISE MEN, FRANKINCENSE WAS WORTH ITS WEIGHT IN GOLD IN ANCIENT TIMES. IT'S STILL BURNED FOR ITS FRAGRANCE AND IS ALSO USED IN AN OMANI PERFUME, AMOUAGE, ONE OF THE WORLD'S MOST EXPENSIVE AT $220 AN OUNCE.

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DIG THIS

Chef Alice Waters has a recipe for getting kids to eat their veggies

The secret? Let kids grow their own food, says Waters (in the Edible Schoolyard in Berkeley).

WHEN THE influential chef and natural foods advocate Alice Waters shows up on the National Mall this summer, she'll tend to artichokes, tomatoes and mesclun (greens and herbs). No, the founder of the legendary Berkeley, California, restaurant Chez Panisse hasn't taken a groundskeeper gig. She's participating in the Folklife Festival's Food Culture USA exhibit, where Smithsonian horticulturists are planting a temporary version of Waters' Edible Schoolyard. She started the garden-centric educational program at a Berkeley middle school about a decade ago to teach young people how food gets to the table—and how to eat better. SMITHSONIAN spoke with the dinner-table diva this spring.

You say you can get any child to eat Swiss chard. That really happens?
You should see, after six weeks or so, they're all eating salad. It's a wonderful thing.

And they're not making faces?
No, because they were involved in the whole process. They have a kind of pride in it. They've made the vinaigrette themselves, they've tossed the salad. They've served their friends, they want to know what they think of it, they eat it themselves.

Can a food-based curriculum fill in for parents who can't—or don't—sit down for regular meals with their kids?
That's part of the idea. Parents aren't eating with their children anymore. They aren't communicating a whole sense of our culture around the dinner table, the place where we become civilized. We need to learn about the relationship of food to agriculture and food to culture.

What happens when kids learn to see that connection?
When kids grow food and cook it and serve it, they want to eat it. All of the very important ideas about sustainability and nutrition come in by osmosis. They're engaged with all of their senses. Once they've spent a year in the program, they know where the compost heap is, they know what compost *is*, they know when the raspberries are ripe, they know how to plant seeds.

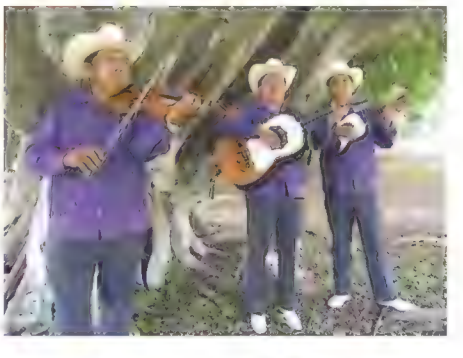
Do adults need an Edible Schoolyard as much as kids do?
They absolutely do. But we need to get to these little kids and begin in kindergarten, so when they grow up, they'll understand this set of values.

What if money's tight and access to farm-fresh food is limited?
We need to learn how to cook. The cheap food that's available to people is killing them, making them sick. I think grocery stores change when people ask for certain things to be put in them, but nobody asks. When you're selling food in season, there's always a good price for one fruit or vegetable.

But how do you convince kids to choose arugula instead of a cookie?
You have to have an educational program to bring you into another relationship with food. Food is about care, and can be about beauty, and communication, and meaningful work, a whole lot of values that are way more seductive than what fast food has to offer you. I think kids are hungry for that. —*A.B.*

HURRY IN

THE 39TH ANNUAL SMITHSONIAN FOLKLIFE FESTIVAL spotlights the history of the U.S. Forest Service, trends in American cuisine, the crafts and culture of Oman, and Latino music traditions (right, Los Camperos de Valles, from the Huasteca region of northeastern Mexico). The festivities take place on the National Mall June 23 through 27, and June 30 through July 4.



THOMAS HEINSER, SMITHSONIAN FOLKLIFE FESTIVAL

VISIT THE SMITHSONIAN For a free Associates' planning packet, call Smithsonian Information, 202-357-2700 or 202-357-1729 (TTY), 9 a.m.-5 p.m., Monday through Saturday, or send an e-mail to info@si.edu. **INFORMATION CENTER:** Upon arrival, stop at the Smithsonian Information Center in the Castle (9 a.m.-5:30 p.m.). Members are invited to drop by the reception desk (9 a.m.-4 p.m.) to register for a behind-the-scenes tour and to hear about membership benefits. Most museums are open daily, 10 a.m.-5:30 p.m., except December 25.

ELIMINATING EMISSIONS AND DOUBTERS.

Someone should make hydrogen vehicles and their refueling stations a reality. Only GM could.

Only General Motors has teamed up with Shell to introduce the nation's first hydrogen refueling pump at a retail station. It's the endgame of a multi-faceted strategy GM set in motion years ago to make cleaner cars and trucks powered by hydrogen. Right now, a test fleet of hydrogen-powered GM vehicles is negotiating traffic in downtown Washington, D.C. GM introduced the first fuel cell-powered concept vehicle nearly forty years ago, and we've continued to push fuel cells forward ever since. With over five hundred GM engineers on three different continents working on hydrogen technologies, it's clear the hydrogen economy isn't a pipe dream anymore.

CHEVROLET PONTIAC BUICK CADILLAC GMC SATURN HUMMER SAAB Only GM

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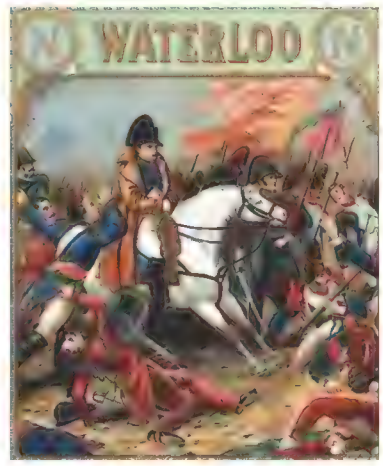
THIS MONTH IN HISTORY

JUNE ANNIVERSARIES—MOMENTOUS OR MERELY MEMORABLE

110 YEARS AGO: HORSELESS
Illinois inventor Charles Duryea patents a gas-driven "road-vehicle"—the first American car to be commercially produced—in June 1895. He and his brother Frank will make 13 "Duryeas," capable of 20 mph speeds, before each goes solo in 1898.

25 YEARS AGO: HERE'S THE NEWS
The first 24-hour news channel, Cable News Network (CNN), debuts June 1, 1980, with Lois Hart and David Walker anchoring. Founder Ted Turner's plans to "deliver a newspaper electronically" are met by skepticism, but by 2005 satellites beam the channel's live news feeds to more than 200 countries, and the power of instantaneous media coverage to affect consumption or government policy is known as the "CNN effect."

20 YEARS AGO: FINAL REST
Karen Ann Quinlan, 31, dies of pneumonia June 11, 1985. In 1976, Quinlan, in a "persistent vegetative state" after combining tranquilizers and alcohol, made headlines in a landmark "right to die" legal battle. The New Jersey Supreme Court, ruling that a guardian or proxy could refuse treatment on behalf of an incompetent patient, allowed her father to disconnect her respirator. Quinlan, still on a feeding tube, lived an additional, unexpected nine years.



190 YEARS AGO: DISMAL PLAIN
After escaping from exile on Elba, Napoleon Bonaparte makes a last bid for empire near Waterloo, Belgium, on June 18, 1815. In a battle now synonymous with ultimate defeat, his 72,000 French troops are repelled by the Prussian Army and forces led by Britain's Duke of Wellington, and suffer 25,000 casualites. Forced to abdicate a second time, Napoleon is again exiled, to St. Helena Island, where he dies, at 51, in 1821.

100 YEARS AGO: GRAND DAME
Playwright Lillian Hellman is born in New Orleans June 20, 1905. Already controversial by her early 30s for plays such as *The Children's Hour*, about the power of gossip to destroy, in 1952 she refuses to name names when suspected of Communism by the House Un-American Activities Committee, saying: "I cannot and will not cut my conscience to fit this year's fashions." She dies at 79 in 1984.

—ALISON McLEAN

1550 YEARS AGO: WHEN IN ROME
Gaiseric, king of the Vandals, a Germanic people long at war with Rome, sails his men up the Tiber River and pillages the city for two weeks in June 455. Rome's emperor having recently been murdered, Gaiseric faces no opposition. He makes off not only with treasures from the Temple of Jerusalem—booty from Titus' A.D. 70 sacking of that city—but also the emperor's widow, Eudoxia, and her two daughters. Imperial Rome falls for good in 476.

CLOCKWISE FROM TOP LEFT: BETTMANN / CORBIS; CNN; AP / WIDE WORLD PHOTOS; POPPERFOTO / ALAMY; AKG-IMAGES; ARNOLD NEWMAN / HULTON ARCHIVE / GETTY IMAGES

What tobacco issue is important to you?

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HAZY DAYS IN OUR PARKS

THE AIR IN MANY NATIONAL WILDERNESS WONDERLANDS IS GETTING WORSE. AS OFFICIALS DEBATE CONTROVERSIAL NEW RULES TO CURB POLLUTION, SCIENTISTS FIND THE SOURCES ARE SURPRISINGLY FAR-FLUNG

BY CHARLES PETIT

Oh, say, can you see? Over the past century, man-made haze has significantly cut visibility in many of the 58 national parks (the Grand Canyon). Several sanctuaries have pollution as severe as that in big cities—and the air won't improve unless fossil fuel emissions are reduced.

BIG BEND NATIONAL PARK'S superintendent, John King, calls the 801,163-acre reserve on the West Texas border with Mexico a "destination park," meaning for most folks there's little other reason to venture into the area at all. Reaching it takes four hours on a two-lane road from Midland, the nearest major airport. In between is the flat, scraggly Permian Basin, the state's historic oil patch, dotted with dying and dead "horsehead" walking-beam pumps and filled with the pungent odor of black gold wafting from those still in production. But even in scorching summer heat, when temperatures average more than 90 degrees, the trip is worth it. Mesas and buttes pop up as one nears the oversize oxbow in the Rio Grande that gives the region its name, and the terrain turns to the classic Chihuahuan Desert of purple-tinged prickly pear, spiny ocotillo, sharp-barbed lechuguilla, and yuccas spikier on top than any punk rocker.

Since the late 1980s, the remote park has been plagued by an unexpected problem: haze. "I've had people come out, take a look around, and tell me they had to get going back to Houston for some clean air," says Big Bend's air quality technician, John Forsythe. Hall Hammond, a San Antonio jewelry sales consultant who has visited the park 60 times since 1969, is an activist with the private Friends of Big Bend National Park, a group that supports the Texas park. He remembers when he used to ask friends to float down the river with him and stare up from the canyon at what he called Big Bend blue. "The sky would just be cobalt," he recalls. But lately that hue is rarer and rarer. In 1998, Hammond hiked up Emory Peak in the Chisos Mountains, looked down from its 7,825-foot height and saw "this yellow layer sitting down on the desert to the north and east. It just completely threw me."

The air has been going bad in many parks for decades, affecting views and endangering the health of visitors, plants and wildlife. Last year, the National Parks Conservation Association (NPCA), a nonpartisan watchdog group based in Washington, D.C., listed the five most polluted national parks. Relying almost entirely on data from the National Park Service and the EPA, the group says the parks with the worst visibility and most severe ozone and acid rain levels are the Great Smoky Mountains Park on the Tennessee-North Carolina border, followed by Mammoth Cave in Kentucky, Shenandoah in Virginia, Acadia on the Maine coast, and the jointly operated Sequoia and Kings Canyon National Parks in California's Sierra Nevada. Many parks have been hard hit by sulfur dioxide and nitrogen oxide from coal-fired power plants, which are responsible for nearly 70 percent of sulfur dioxide and 22 percent of nitrogen oxide emissions nationwide. The park service, while it disagrees with the way the NPCA assessed some of the pollution data, has little quarrel with the report's general tenor.

Eastern parks, many downwind from huge coal-fired power plants in the Ohio River Valley and elsewhere, are the worst hit, in keeping with national pollution patterns. Over the past century or so, man-made haze has cut average visibility in the eastern half of the country from 90 miles to between 15 and 25 miles. In the arid and naturally clearer western states, visibility has dropped from 140 miles to 35 to 90 miles. Parks famed for their views—Grand Canyon in Arizona, Yellowstone in Wyoming, Montana and Idaho, Yosemite in California, Colorado's Rocky Mountain, and Big Bend—have long bouts of murky, polluted air each year.

Because federal rules have long mandated that national parks and other wilderness areas should have the cleanest air in America, regulators have been authorized to take action

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against known polluters, typically by suing them for noncompliance. But as pollution-control laws have become increasingly complex, companies accused of violating park air-quality standards have gone to court to delay enforcement, stalling cleanup efforts. The Bush administration has proposed overhauling air pollution regulations, replacing the current, plant-specific air quality standards with a barter system; power plants would buy or trade pollution credits, allowing them to exceed pollutant limits in some places. Proponents say the administration's Clear Skies Initiative will ultimately improve air quality by lowering emissions. But critics say that the changes will reverse progress against dirty air—and allow egregious polluters to stay in operation.

KEVIN TAYLOR / IPN

Views of Big Bend National Park in Texas are marred by "this yellow layer sitting down on the desert," says frequent visitor Hall Hammond. The remote 801,163-acre park was recently the site of an ambitious, wide-ranging study of haze sources.

The political debate over air pollution laws underscores the plight of the parks. "There is still that vision that you can go out to the parks and breathe fresh mountain air, and get away from the urban problems that we all see, and stand in that pristine natural world," says NPCA president Tom Kiernan, who worked from 1989 to 1992 as an EPA official in the first Bush administration. "Yet we see, by god, that we have some of the worst air in the country in the national parks."

Why? An extraordinary scientific study conducted in an isolated stretch of Texas is yielding some answers. The implications—for the regulatory debate, for the health of the parks, even for the health of parkgoers—give new meaning to the idea of far-reaching.

BIG BEND is a historic place. Comanche, Apache and other tribes defied 300 years of Spanish and Mexican rule in the rugged badlands. It was the last redoubt of Indian warrior Victorio and his Mescalero Apache, finally scattered in 1880 by U.S. Army troops. The park's center is crowned by the rugged escarpments of the Chisos Mountains massif, giving it the look of a fortress.

In the 1990s, Big Bend's growing haze spurred wide suspicion that the pollution originated across the river, 140 miles to the southeast. By 1995, two big coal-fired Mexican power plants, Carbón I and II, were generating 2,600 megawatts of electricity without significant emission controls.

In a joint effort, the EPA, the park service, the Texas Commission on Environmental Quality, the U.S. utility industry's Electric Power Research Institute and the National Oceanic and Atmospheric Administration launched the Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study. From July through October 1999, a small tent and trailer city sprang up in a scrubby corner of the park. Instruments sprouted at dozens of locations in or near Texas. Scientists around the state injected different perfluorocarbon chemicals into the sky, and monitors in the park recorded the tracers as they arrived. Mexican officials, apparently afraid they were being set up to take the blame for Big Bend's bad air, had backed out of the study; so U.S. scientists, unable to put tracers directly into the Carbón plants' plumes as hoped, released them from a tower in the Texas border town of Eagle Pass, 20 miles from the plants.

The BRAVO researchers made their results public this past September. The short version? Don't blame Mexico. In fact, the park's worst haze comes from the eastern United States and East Texas. Mexico's Carbón I and II plants remain the biggest single contributors to Big Bend's sulfate haze. But on the haziest days, they contribute just 9 percent of the total, and the rest of Mexico another 7 percent. Texas adds 11 percent, the eastern United States 22 percent and the western United States 4 percent. The rest of the haze arises from windblown soil, smoke from agricultural and forest fires, manufacturing activities and vehicle exhaust. Mark Scruggs, assistant chief in the National Park Service's air resources division, which monitors pollution in the parks, says the big surprise was how much sulfate originates in the eastern United States, borne on prevailing winds that blow across East Texas or loop down to the Gulf of Mexico and north through the Mexican mainland (see graphic, p. 59). Mexican officials had been arguing since 1996 that Big Bend's problems came from north of the border—including a string of power plants along the Ohio River Valley—but the Americans were skeptical until the BRAVO data came in.

Ever since Congress created the first national park, at Yellowstone in 1872, the parks have enjoyed special legal protections. In 1916, the National Park Service was set up to maintain areas "unimpaired for the enjoyment of future generations." Additional legal backing came in 1977 when amendments to the Clean Air Act gave parks the highest priority, designating them as Class I areas. The law is emphatic: "Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution."

"It was visionary to try to protect these areas without even knowing how difficult it would be," says air resources division director Chris Shaver. The division has outfitted most major parks with filters to gather aerosols, or ultrafine solid and liquid particles in the air; nephelometers to measure how haze scatters sunlight; and transmissometers that gauge scattering and absorption of light by pollution, dust, mist or other material in the air. Chemical samplers scrutinize the concentration of such problematic molecules as ozone, which can be harmful to humans at ground level.

Shaver remembers standing on the rim of the Grand Canyon with her then 6-year-old daughter, Courtney, in 1990. The girl looked at the barely visible cliffs on the other side and said, "Mom, I don't know how to tell you this, because I know how hard you are working, but you're not doing a very good job." Courtney graduated from college this year, and

"Some of the worst air in the country [is] in the national parks," says conservation advocate Tom Kiernan (at Big Bend in April), a former EPA official. A White House proposal to revise air pollution laws is being praised as efficient and criticized as lax.

STEVEN PUMPHREY

On Big Bend's worst days, more than half of the haze is caused by sulfates. As the map shows, more of the sulfates come from the eastern U.S. than nearby Carbón facilities in Mexico. Implication? Air pollution isn't just local.

Shaver still sees haze in the park system. When researchers started measuring the Grand Canyon's air quality in the 1970s, "Congress and most people thought we had a problem with [only] a few power plants in the four corners," she says of the region where Arizona, New Mexico, Colorado and Utah meet. Since then, while these power plants have slashed their overall sulfur emissions by 72 percent, the canyon's haze remains—evidence that the problem isn't merely local.

Whether the Bush administration's proposed air quality regulations will more effectively reduce pollution in the worst-hit parks is hotly debated. The present system "is tied up in the courts," says Jim Connaughton of the White House Council on Environmental Quality. The Clear Skies Initiative aims to replace the strict limits governing an individual power plant's emissions of sulfur dioxide and nitrogen oxides with a "cap-and-trade" system. A plant that exceeds a limit for a pollutant would buy or trade credits from an operator that was under the limit for the same compound, keeping the nation's overall pollution in check. Proponents, including many Republicans and most industry lobbies, say the plan is simpler, allows companies to be flexible, and lets some stay in business without buying expensive clean-up equipment. If a plant goes over its limit and has no credits to buy its way clear, EPA officials can levy fines with fewer hearings and lawsuits.

Connaughton also says that the proposal preserves long-term national goals on clean air and will improve visibility in the national parks. The proposal aims to reduce emissions of sulfur dioxide, a prime cause of haze and acid rain, by 73 percent by 2018—down 8 tons from the 11 million tons emitted in 2000. At the same time it would cut nitrogen oxides, a cause of ozone, by 67 percent.

But opponents see Clear Skies as a sellout to industry. They say the proposal is less aggressive than current regulations, and they complain that it would let dirty power plants operate as long as their owners buy credits elsewhere. Many environmental organizations have attacked the proposals. "Why is the Administration bragging about a plan that will actually result in more pollution than if we simply enforced the existing Clean Air Act?" the Sierra Club asks. In 2002, Eric Schaeffer quit his job as the EPA's regulatory enforcement head, protesting what he says is the Bush administration's soft approach to power company pollution. "If you allow them to buy their way out of reducing emissions, then the parks may not get better for a long time," he says. Clear Skies opponents also say the plan would put park air at risk because the cap-and-trade credit system takes the teeth out of the parks' Class I designation. Park superintendents

MIKE STERN

would no longer have clear authority to demand that the EPA or other agencies go after individual polluters. The Clear Skies legislation is currently stalled in a Senate committee.

Bartering has worked in the past. Since 1990, power plants have been allowed to use a cap-and-trade system to help reduce acid rain, produced largely by coal-fired plants spewing nitrogen and sulfur. Consequently, sulfur emissions went from 17.3 million tons in 1980 to 10.6 million tons in 2003.

Park service expert Mark Scruggs is guardedly optimistic about the Clear Skies Initiative. "If the caps are stiff enough, sure, it will help a lot," he says. "A 70 percent cut in sulfur dioxide is going to make a difference, especially for the East Coast parks." But Scruggs says that when the current system is at its best—when agencies work together to prosecute individual polluters—results are impressive. EPA pressure on industry led to improvements in scrubber technologies, which reduce smokestack emissions, with 95 to 98 percent elimination of some pollutants now commonplace. Scruggs says similar improvements are possible for other pollutants.

But park lovers shouldn't expect big improvements soon. The EPA's deadline for returning park air to normal is 2064, a date instructive both in its temporal distance and legalistic precision. To be sure, there have been isolated gains. Sulfate haze tends to be dropping in the East, even as nitrate pollution and ozone are rising a bit in the West. In January, the park service said it met its 2004 performance goal of achieving stable or improving air quality in at least 62 percent of monitored parks, with 15 getting cleaner and 16 staying the same. Still, 18 got worse—including high-profile destinations such as Acadia, Death Valley, Grand Canyon and Yellowstone.

"We're at the end of the tailpipe," says Ken Olson, president of the Friends of Acadia. Pollutants emitted as far away as the Ohio River Valley cook in the sun as they are blown east, their ozone and acid levels rising as they move. "We get days when the visibility is just terrible [and] palpably polluted," he says.

And don't let the Smoky Mountains' name fool you. The nation's most popular park, at 9.2 million visitors a year, once offered terrific views year-round. The "smoke," known to the Cherokee long before the Industrial Revolution, is a bluish haze of moisture and natural organic particles that hangs on the hills.

Today, one of the worst pollutant concentrations in any national park has created a more unwelcome haze. Jim Embry, an architect in the tourist-happy town of Gatlinburg, Tennessee, north of the park, built a house in 1966 on Mount Harrison, facing the park. Two walls are almost all glass, with a scenic vista of majestic 6,593-foot Mount LeConte. Good views of the mountains are less and less common, he says. "I am watching them disappear before my eyes."

THE AIR in California's Sequoia and Kings Canyon National Parks is essentially hostage to geography and climate. In the southern Sierra overlooking California's broad San Joaquin Valley, the 865,952-acre pair of parks range from rolling foothills and oak woodlands to granite peaks. Founded in 1890, Sequoia is the nation's second-oldest national park, after Yellowstone. Its eastern border crosses the summit of Mount Whitney, at 14,494 feet the loftiest point in the 48 conterminous states. The parks hold 30 groves of giant sequoia, the world's largest tree. Many are thousands of years old, 30 feet or more across at chest level, and taller than a 26-story building.

In winter, when the air is clearest, the vista from a snowy scenic outlook toward the San Joaquin Valley seems etched in crystal. From late spring through fall, though, dawn typically brings an ugly sight: a gray-brown murk that rises like a tide as the day warms. The miasma, says air resources specialist Annie Esperanza, even looks like a river as it flows into the park. Natural visibility at Sequoia should be 122 to 158 miles, the EPA says. But summer views average less than 40 miles, and on the worst days can drop below 6.

Though the parks are just 230 miles from Los Angeles, the problem is not Southern California sprawl. Instead, scientists have found that the pollution originates as fresh air off the Pacific picks up pollutants from the urban industrial complex around San Francisco Bay. As the air spreads south into California's sun-blasted Central Valley, it picks up more fine aerosols, sulfur dioxide, soot, dust and ozone-making nitrogen compounds from fast-growing cities, intense agriculture, busy Interstate 5 and other highways crowded with cars and diesel tractor-trailer rigs. The air is walled in by the Coast Ranges to the west, the Sierra Nevada to the east and the Tehachapi Mountains to the south, creating an eddy of recirculating and concentrated pollution before it wafts into Sequoia and Kings Canyon.

Bill Tweed, Sequoia and Kings Canyon's chief park naturalist, figures that the southern San Joaquin Valley is the na-

NATIONAL PARKS WITH THE MOST UNHEALTHY AIR DAYS, 1999-2003

305	Sequoia and Kings Canyon (California)
138	Joshua Tree (California)
102	Great Smoky Mountains (North Carolina and Tennessee)
48	Yosemite (California)
36	Shenandoah (Virginia)
30	Mammoth Cave (Kentucky)
27	Acadia (Maine)
16	Rocky Mountain (Colorado)
5	Death Valley (California and Nevada)
4	Congaree (South Carolina)

Source: National Park Service. An unhealthy air day is defined by EPA as 8-hour average ozone concentrations of 85 ppb or higher.

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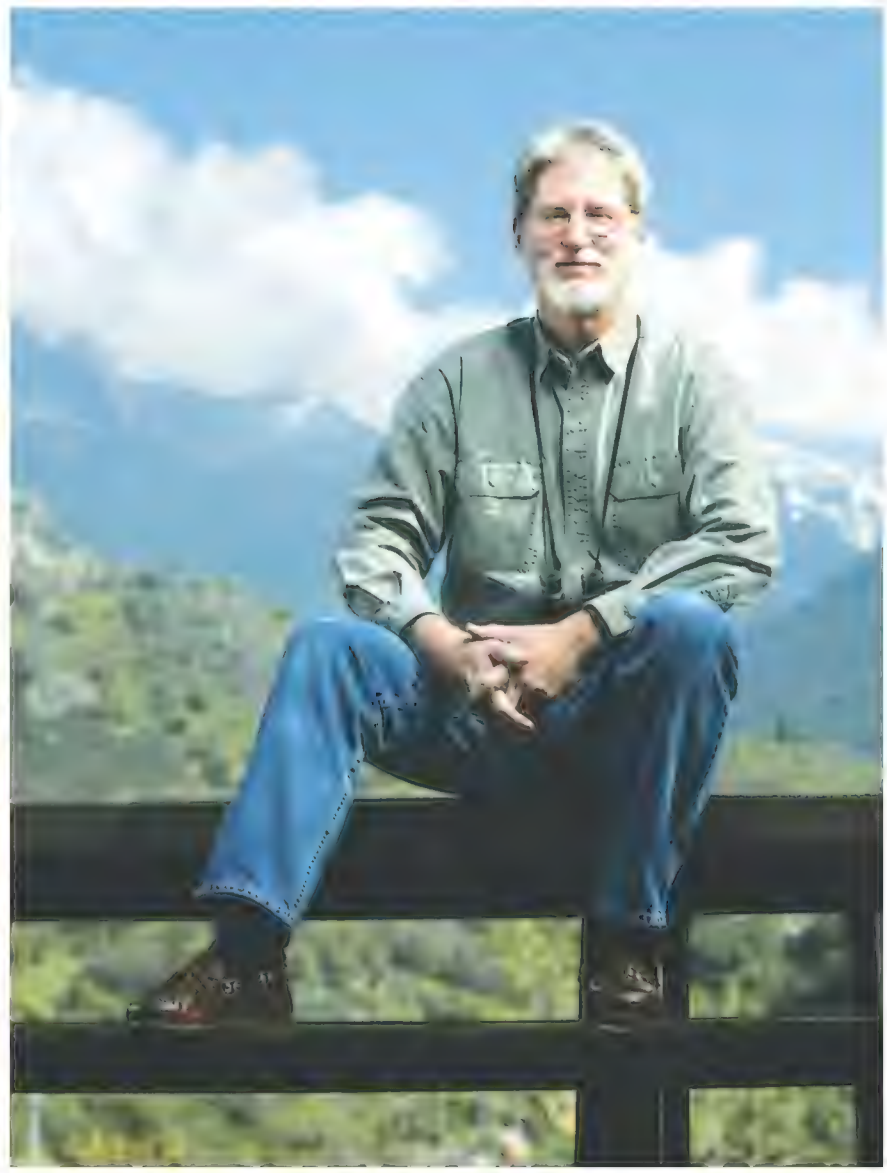

Pollution in some parks is "like the canary in the mine," says Chris Shaver (left, near Denver), head of the park service's air resources division. Parks veteran Bill Tweed of Sequoia and Kings Canyon recalls seeing clear across the San Joaquin Valley.

MICHAEL LEWIS; RYAN KRAUTER / VISALIA TIMES DELTA

tion's most efficient smog pot. The air, Tweed says, "just cooks and cooks and cooks in a warm, summer, cloudless climate." To make things worse, the valley's population is on track to double over the next four decades, to more than seven million. "We've already gone from a broth to a stew, and if we're not careful our stew will turn into a chowder," Tweed says. "The best way to enjoy a park is to just go out and walk. You must get out of your car to enjoy a park. But on a fair number of days, it is not even healthy to get outside and walk. That is a most direct assault on our mission."

Ozone, park officials say, has hurt 90 percent of the parks' Jeffrey pines. So far, the mature giant sequoia appear to be OK, but their seedlings may be suffering. In the Foothill Visitors Center at Ash Mountain, park workers post air advisories for the public and staff. On bad days, a sign tells visitors to avoid extended hikes. On 52 days last year, the parks' ozone levels exceeded the EPA "unhealthy air" standard of 85 parts per billion for eight hours. And 2004 was a good year; 2002 saw 80 unhealthy days, contributing to a 305-day unhealthy air total for the span 1999-2003—just 68 fewer than Los Angeles.

"I can't even bring my kids up here unless I know we're going to have clean air," says Laura Whitehouse, NPCA's local representative. Her three children all have severe asthma. In May 2004, thinking the air would be tolerable, she took them into the park. Her 9-year-old son, Aaron, complained of chest pains in the parking lot and plunked down on a bench, wheezing badly. Paramedics had to bring a nebulizer to clear up the boy's lungs. "It's sometimes worse up here than in the valley," Whitehouse says.

In 1967, Bill Tweed was 18 and working as a bellboy at the lodge at Sequoia and Kings Canyon. With July 4 coming up, veteran employees let him in on a local tradition: load up backpacks with beer and other refreshments and scale Moro Rock, a bald monolithic knob near park headquarters. For generations, its lordly 6,725-foot-high view across the San Joaquin Valley to the west had provided a granite throne for simultaneously looking down on fireworks spouting from Fresno, Visalia, Dinuba and other communities. But that year not a flicker was to be seen. "Everybody said it had been happening more and more often," Tweed recalls. Within a few years, the Fourth of July climb was kaput, killed by haze.

As Tweed lists the man-made threats to the parks—climate change, invasive species, forests choked by overzealous fire suppression, nitrogen air pollutants that overfertilize plants, ozone—he's not optimistic that Moro Rock Independence Day viewing will return any time soon. "We are making it harder and harder to carry out the legal mandate to maintain these parks in their natural state," Tweed says. "What we don't know now is, can we ever get back?"

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BOAR WAR

A MARAUDING HOG BITES THE DUST IN A BORDER DISPUTE BETWEEN THE UNITED STATES AND BRITAIN THAT FAILS TO TURN UGLY

BY DEBORAH FRANKLIN

AMERICAN BERKSHIRE ASSOCIATION; RICHARD ROCHE / BRITISH COLUMBIA ARCHIVES / E03113

An ambiguous treaty had led to rival British and American settlements (above, the U.S. Army's Third Artillery in a photo taken by a Royal Navy officer) on San Juan Island in 1859, when Charles Griffin's pig provoked a 12-year standoff between the two nations.

In a classroom on San Juan Island, Washington, across the Haro Strait from Victoria, Canada, a man in uniform was showing 26 fifth graders how to load a rifle. "It looks old, but it's a weapon of modern warfare, mass-produced in a factory in Harpers Ferry, Virginia, in the mid-19th century," said Michael Vouri, a National Park Service ranger at San Juan Island National Historical Park. "It fires .58-caliber bullets—huge lead balls—and was designed specifically to hurt and kill people. It can hit a man from five football fields away, and when it strikes bone, the bone splinters in every direction." Silent and saucer-eyed, the kids craned for a better look.

Vouri lowered the rifle and held it out for closer inspection. "This is the sort of gun that almost started a war, right here on this island, between the United States and England, in 1859," he said.

So began another of Vouri's retellings of the boundary dispute between the United States and Britain that threatened to pitch the two nations into their third bloody conflict in less than 100 years. Few people outside of San Juan Island have ever heard of the Pig War—whose peaceful outcome makes it an all-too-rare example of nonviolent conflict resolution—though in 1966 the U.S. government created the San Juan Island National Historical Park to commemorate it. Vouri, a Vietnam veteran who wrote a book about the standoff, believes it holds lessons for today.

By 1859, forty-five years after the inconclusive settlement of the War of 1812, the United States and Great Britain had developed an uneasy entente. The "Anglo-American Convention" of 1818 had solidified England's control over the eastern half of what we know today as Canada, and citizens from each nation were moving ever west across the North American continent. The convention also established the border between the United States and Britain along the 49th parallel from the Lake of the Woods, bordering what is now Minnesota, west to the Rocky Mountains. Under its terms, the two countries would jointly administer the so-called Oregon Country northwest of the Rockies for ten years. In theory, unless either nation could decisively show that it had settled the region, the treaty would be renewed.

But renewal always seemed unlikely. To the thousands of Yankee settlers and fortune seekers who poured into the Oregon Territory during the mid-19th century, this half-million-square-mile swath of land—comprising today's Oregon, Washington, Idaho and parts of Montana, Wyoming and British Columbia—represented a promised land. The same was true for English merchants, who craved the region's deep ports and navigable rivers as lucrative highways for trade.

Mike Vouri (as Pickett in a 2004 reenactment) says it was an odd war: "Both sides attended church together each Sunday."

BRIAN SMALE

For decades, the Hudson's Bay Company, a private fur-trading corporation that functioned as England's surrogate government in the territory, had lobbied for a border that would keep the Columbia River—a crucial pipeline for pelts—in English hands. But by the 1840s, British trappers found themselves vastly outnumbered. The U.S. population had swollen from more than 5 million in 1800 to 23 million by mid-century, and a heady sense of Manifest Destiny continued to drive farmers west. "In 1840 there were 150 Americans in all of Oregon Country," says University of Washington historian John Findlay. "By 1845 that number had jumped to 5,000, and Americans were feeling their oats."

Tensions had peaked in 1844 when under the slogan "Fifty-four forty or fight," Democratic presidential candidate James Polk promised to push the U.S. border almost 1,000 miles north to 40 minutes above the 54th parallel, all the way to Russia's territory of Alaska.

But Polk, who went on to beat Kentucky Whig Henry Clay for the presidency, sent the U.S. military not north but south in 1846, into a two-year war with Mexico. That conflict ultimately expanded the United States' southern border to include Texas, California and most of New Mexico, and it stretched the frontier army almost to the breaking point. Another war on another front hardly seemed possible. "Polk wasn't stupid," says Scott Kaufman, author of *The Pig War: The United States, Britain, and the Balance of Power in the Pacific Northwest, 1846-72*. "He wanted territory—no question. But he wasn't prepared to go to war with Britain about it."

The treaty of 1846 left a lot to be desired, including disposition of San Juan Island (circled). When vague wording left unclear which navigable channel between Vancouver Island and the mainland formed the boundary between British and American territories, both sides claimed San Juan.

England's territorial ardor in the Oregon Country had also cooled. Fur profits in the Pacific Northwest had begun to decline, partly due to overtrapping by settlers. As a result, maintaining exclusive control of the Columbia River now seemed less important. "In 1846," Kaufman says, "both sides thought, 'We've got to cool things down. Let's just get this treaty signed. Let's move on.'"

Indeed, on June 15, 1846, the United States and Britain signed a new agreement. The Treaty of Oregon stated that the new boundary "shall be continued westward along the forty-ninth parallel of north latitude to the middle of the channel which separates the continent from Vancouver's Island, and thence southerly through the middle of the said channel, and of Fuca's Straits, to the Pacific Ocean. . . ."

As clear as that may have sounded to diplomats on both sides of the Atlantic, the treaty contained a loophole big enough to drive a warship through. At least two navigable channels run south through that region, with a sprinkling of forested islands—chief among them San Juan—strategically situated in the middle. To which country did these islands, with their cedar and fir forests, rich topsoil, deep ponds and mountaintop-lookouts, belong? The chief negotiators for the Crown and the president eventually dismissed such questions as details to be worked out later.

IN DECEMBER 1853, to help strengthen Britain's claim on the territory, Hudson's sent Charles Griffin to San Juan Island to run a sheep ranch. Griffin named his place Belle Vue for its vistas of soaring eagles, whale-filled bays and snow-capped peaks. For a while, Griffin and his staff and livestock enjoyed the run of the entire 55-square-mile island.

But by the mid-1850s, Americans were beginning to stake their own claims on the island. In March 1855, a brazen sheriff and his posse from Whatcom County on the Washington mainland confiscated some of Griffin's sheep in the middle of the night, calling the animals back taxes. The raid was deliberately provocative. "The issue was less about tax collection and more about sovereignty," says University of New Mexico historian Durwood Ball. "Americans believed that the U.S. expansion all the way to the Pacific Coast was the will of God, and success in the Mexican War had only fired up that conviction. They figured they could take the British." By 1859, drawn to the island in the aftermath of a gold rush along the nearby Fraser River, more than a dozen Americans

DEBORAH FRANKLIN has written for these pages on diatoms and walking sticks. Her book on San Francisco's Presidio is due out this fall.

BETTMANN / CORBIS

The settlers complained bitterly about their treatment by the British. It wasn't long before they brought up the pig.

had set up camps there. One of them was Lyman Cutlar, a failed gold prospector from Kentucky who in April of that year staked out a claim with a small cabin and potato patch right in the middle of Griffin's sheep-run.

Cutlar said that the governor of Washington himself had assured him—erroneously, as it turned out—that the island was part of the United States. Therefore, Cutlar claimed that as a white male citizen over 21 years of age, he was entitled, under the Donation Land Claim Act of 1850, to 160 free acres. (He was wrong, again; "preemption" land acts that provided free or discounted property to Western homesteaders did not apply to the disputed territory.)

As it happened, Cutlar's potato patch was poorly fenced ("three-sided," according to official complaints), and Griffin's animals soon took to wandering through it. According to Cutlar's subsequent statements to U.S. officials, on the morning of June 15, 1859, he awoke to hear derisive tittering from outside his window.

Rushing from his house with a rifle in hand, Cutlar reached the potato patch to see one of Griffin's hired hands laughing as one of Griffin's black boars rooted through Cutlar's tubers. An incensed Cutlar took aim and fired, killing the boar with a single shot.

Thus was fired the opening and only shot of the Pig War, setting off a chain of events that almost brought two great nations to blows. ("Kids always want to know who ate the pig," Vouri says. "No one knows.") Cutlar offered to replace the pig, or, failing that, to have Griffin choose three men to determine a fair price for it. Griffin demanded $100. Cutlar sputtered: "Better chance for lightning to strike you than for you to get a hundred dollars for that hog."

Cutlar stomped off, and Griffin alerted his superiors at the Hudson's Bay Company. They, in turn, called on the American's cabin, demanded restitution and, depending on whose story you believe, threatened him with arrest. Cutlar refused to pay and refused to go with them, and the British, not wanting to force the issue, left empty-handed.

A few weeks later, in early July, Gen. William S. Harney, the commander of the U.S. Army's Oregon Department, toured his northern posts. Noticing an American flag that Cutlar's compatriots had raised on the island to celebrate July 4, he decided to investigate. The American settlers complained bitterly to him about their vulnerability to Indian attacks and their treatment by the British, and asked for military protection. It wasn't long before they brought up the incident with the pig.

Although Harney had just days before paid a cordial call on British territorial governor James Douglas to thank him for his protection of American settlers against Indian attacks, the general—a protégé of Andrew Jackson's who had absorbed his men-

"An American shot one of my pigs for trespassing," Charles Griffin (right) recorded in his journal. The Hudson's Bay Company agent, hired in 1853 to run Belle Vue Farm (below), resolved to have the Americans removed.

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Gen. William Harney (top) believed it was the Manifest Destiny—as popularized by President James K. Polk (upper right) and his slogan "Fifty-four forty or fight"—of Americans to settle the West in general, and San Juan Island in particular. But his command to Capt. George Pickett (center) to put his troops on the island was viewed by Harney's superiors as a disastrous bungle; the U.S. could ill afford a war with Britain. Gen. Winfield Scott (right) was dispatched to negotiate in the hope that cooler heads would prevail.

tor's hatred of the British—saw a chance to settle old scores with an aggressive stroke. (Harney, who would be court-martialed four times in his career, was "excitable, aggressive, and quick to react to any affront, insult, or attack, whether real or imagined, personal or professional," writes his biographer, George Rollie Adams.)

Citing what he called the "oppressive interference of the authorities of the Hudson's Bay Company at Victoria," Harney ordered Capt. George Pickett, a 34-year-old, ringlet-haired dandy who'd graduated last in his class at West Point before being promoted in the Mexican War (for what some deemed reckless bravery), to lead a detachment of infantrymen from Fort Bellingham, Washington, to San Juan Island.

For his part, the British governor also welcomed a confrontation. He had worked for the Hudson's Bay Company for 38 years and believed that Britain had "lost" Oregon because his commanding officer at Fort Vancouver, where he served as deputy, had been too welcoming of American settlers. In an 1859 dispatch to the British Foreign Office, Douglas complained that the "whole island will soon be occupied by a squatter population of American citizens if they do not receive an immediate check."

On July 27, 1859, the steamer USS *Massachusetts* deposited Pickett's 66 men on San Juan Island, where they set up a camp on 900 square feet of windy hillside above the Hudson's Bay Company dock.

Pickett's orders were to protect Americans from Indians and to resist any British attempts to interfere in disputes between American settlers and the Hudson's Bay Company personnel. But Pickett stretched his mandate. He posted a proclamation just above the loading dock, declaring the island to be U.S. property, with himself in charge. The document made clear that "no laws, other than those of the United States nor courts, except such as are held by virtue of said laws" would be recognized.

Strong words for someone whose flimsy camp was in easy range of naval guns. Sure enough, by the end of the very day on which Pickett posted the proclamation, the first guns arrived—21 of them, mounted on the deck of the British warship HMS *Satellite*. Acting in the absence of the Royal Navy's commander of the Pacific, R. L. Baynes, who was making rounds in Chile, Douglas quickly sent two more British ships, including the HMS *Tribune*, to San Juan Island, with orders to prevent any American reinforcements from landing.

For more than a week, American and British troops stared at each other across the water. The *Tribune*'s captain, Geoffrey Phipps Hornby, warned Pickett that if he did not immediately abandon his position, or at least agree to a joint occupation of the island, he risked an armed confrontation. According to one witness, Pickett retorted that, if pushed,

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"Tut, tut, no, no, the damn fools," Baynes said of the order to land troops, when he at last learned what had been going on.

he would "make a Bunker Hill of it," fighting to the last man.

Privately, Pickett was less confident. In an August 3 letter to Alfred Pleasanton, adjutant to Harney, who had by then returned to Fort Vancouver, Pickett noted that if the British chose to land, the Americans would be "merely a mouthful" for them. "I must ask that an express [directions] be sent to me immediately on my future guidance," he wrote. "I do not think there are any moments to waste."

Captain Hornby relayed Douglas' threats to Pickett throughout July and August, but fearing an outbreak of a larger war, he refused to follow the governor's order to land his Royal Marines and jointly occupy the island. (Although nominally under the civilian Douglas' command, Hornby had to answer directly to Admiral Baynes, and British Royal Navy officers at the time had wide discretion in deciding whether to initiate hostilities.) Hornby's gamble paid off. "Tut, tut, no, no, the damn fools," Baynes reportedly said of Douglas' order to land troops, when, returning to the area August 5, he at last learned what had been going on in his absence.

In the meantime, the American detachment had managed to fortify its camp with men, artillery and supplies. By late August, the Americans counted 15 officers and 424 enlisted men, still vastly outnumbered by the British but now in a position to inflict significant damage on Hornby's five ships and the nearly 2,000 men who manned them.

In those days before transcontinental telegraphs and railroads, the news of the fracas on the island did not reach Washington and London until September. Neither capital wanted to see the dispute mushroom into armed conflict. Alarmed by Harney's aggressive occupation, President James Buchanan—who had negotiated the Treaty of Oregon when he was secretary of state—immediately dispatched one of his most gifted diplomats and battlefield generals, Winfield Scott, to resolve the matter.

Scott was familiar with Harney's hot temper, having been involved in two of the general's courts-martial. After Scott finally reached the West Coast in late October 1859, he ordered all but a single company of U.S. troops off the island and negotiated a deal with Douglas permitting joint military occupation of the island until boundary surveys were complete. As Scott sailed home in November, all but one of the British warships withdrew. At Scott's recommendation, Harney was eventually removed from his command.

British governor James Douglas, says a historian, "had no intention to sit back and allow American soldiers to stay" on the island. He sent in the Royal Navy (below, the HMS *Satellite*).

BRITISH COLUMBIA ARCHIVES / A-00912

"Both sides still believed that if San Juan Island was lost, the balance of power—and so the security of their respective nations—would be imperiled," Kaufman says. "Still, I strongly doubt that either side wanted bloodshed."

WITHIN A FEW MONTHS of Scott's departure, comparable detachments of roughly 100 British and American troops had settled on opposite ends of the island. The English built a cozy outpost, complete with family quarters for the captain and a formal English garden. The American camp, in contrast, was exposed to the wind and in disrepair. Subject to political tensions over the impending Civil War, Pickett's men were demoralized. "The difficulty of getting their pay and the refusal of merchants to cash treasury Bills makes the American Officers very anxious," a visiting Anglican bishop wrote in his journal on February 2, 1861. "They say they fully expect next month to be paid. Troops if six months in arrears of pay may disband themselves. 'Here am I,' says Captain Pickett, 'of 18 years standing, having served my Country so long, to be cast adrift!'"

On April 17, 1861, Virginia seceded from the Union. Two months later, Pickett resigned his commission and headed home to Virginia to join the Confederacy, where he would make history in what came to be called Pickett's Charge up Cemetery Ridge in the last fight on the last day of the Battle of Gettysburg. (On that day, July 3, 1863, during 50 minutes of combat, some 2,800 of the men charged to Pickett's care—more than half of his division—were among the 5,675 Confederates killed, captured or wounded. It was a turning point in the Civil War. Pickett survived, only to suffer other defeats at Five Forks, Virginia, and New Berne, North Carolina. Pickett died a failed insurance agent at the age of 50—just 12 years after Gettysburg and 16 years after landing with a few dozen U.S. soldiers to claim San Juan Island.)

Following Pickett's departure, relations between the two occupying forces continued in relative harmony. It wasn't until 1872, in a decision by a panel convened by Germany's Kaiser Wilhelm, brought in as an arbiter, that the San Juan Islands were quietly assigned to the United States. The British took their flag, and their flagpole, and sailed home. With that, the upper left corner of the United States was pinned in place.

The artifacts of the Pig War speak of peace: even these British Minié balls were discarded without having been fired.

IN HIS BOOK on the war that did not quite happen, *The Pig War: Standoff at Griffin Bay*, Mike Vouri writes that the conflict was settled peacefully because experienced military men, who knew the horrors of war firsthand, were given decision-making authority. "Royal Navy Rear Admiral R. Lambert Baynes remembered the War of 1812 when his decks 'ran with blood;' Captain Geoffrey Phipps Hornby had seen the hospital ships of the Crimean War; and U.S. Army Lieutenant General Winfield Scott had led men in battle from Lundy's Lane in the War of 1812 to the assault on Chapultepec Castle in Mexico. These are the men who refused to consider shedding blood over a tiny archipelago, then in the middle of nowhere; warriors with convictions, and most critically, imaginations."

The overgrown site of Pickett's makeshift camp on the southern tip of San Juan Island lies less than a mile from Mike Vouri's office. Like the Coast Salish Indians before them, Pickett and his men had made their temporary home next to a freshwater spring that still bubbles through thick mats of prairie grass. For the 12 years of joint occupation, until 1872, American soldiers cleaned rifles, washed tinware (and clothes and themselves), smoked pipes, pined for sweethearts and drank away their boredom along the spring's banks, leaving empty bottles, broken dishes and rusted blades where they lay. Every so often an artifact of Pickett's days—chipped crockery, clay pipes, tarnished buttons or cloudy marbles—turns up, brought to the surface by animals or the water.

Recently, on a windswept bluff, Vouri picked his way through the marshy grass to show a visitor the water's source. A shard of blue glass glinted in the sunlight through the low-slung branches of a scraggly bush. Vouri stooped to pick up the shard—the square-bottomed lower third of a bottle, shimmering with blue-green swirls of tinted glass that had begun to deteriorate—sick glass, archaeologists call it. Near the bottom edge of the bottle was an embossed date: November 1858, eight months before Pickett and his men landed on the island.

Vouri's latest find will join other broken bottles and artifacts discovered here. In a battlefield, of course, the settled dust also entombs spent shells and arrowheads, grapeshot and mine fragments, broken skulls and shattered bones. But in this old "peacefield" on San Juan Island, the relics are mostly buttons and glass.

BRIAN SMALE (4)

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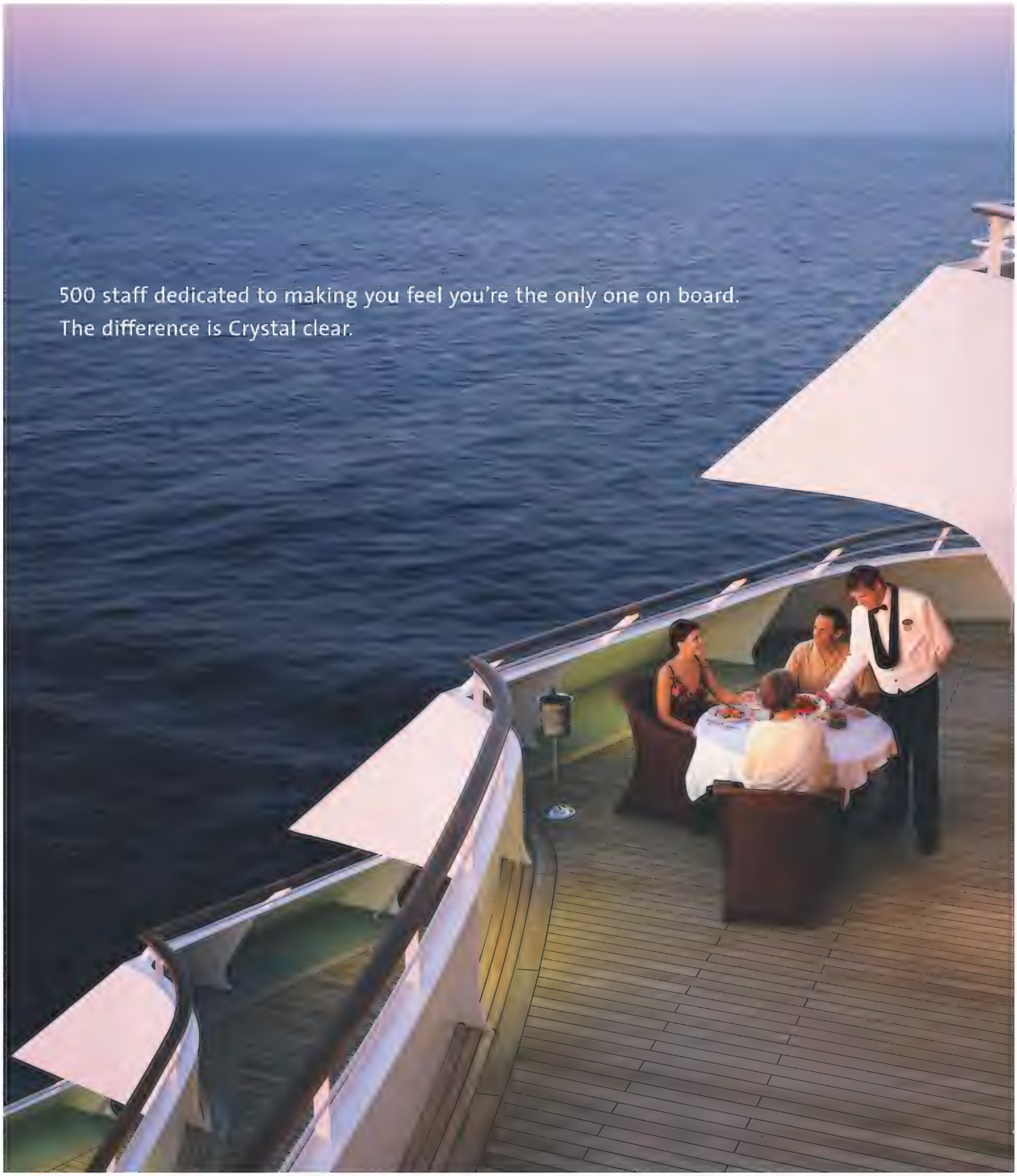

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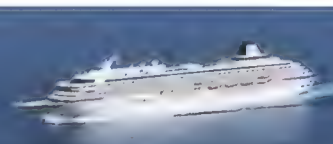


CRYSTAL CRUISES

Gregory Colbert's haunting photographs, exhibited publicly for the first time in the United States, hint at an extraordinary bond between us and our fellow creatures

Animal Magnetism

By Cathleen McGuigan
Photographs by Gregory Colbert

Are they “epiphanies in sepia,” as one critic says? Or “narcissism,” per another? Colbert’s photographs (in Myanmar) both inspire and vex.

THE MOST ARRESTING ASPECT of Gregory Colbert's photographs, in his show "Ashes and Snow," is their air of dreamlike calm. That serenity pervades the sepia-toned pictures, though the people in them—children mostly—pose with enormous elephants, flapping falcons, cavorting whales. There's even a shot of a young girl sitting with a big spotted cheetah as peacefully as if it were a pussycat. Surely, you're bound to wonder, were these images digitized, collaged, somehow toyed with? No, says Colbert, 45, a Canadian-born artist and adventurer who has made 33 expeditions in 13 years to photograph people and animals in places from Egypt to Myanmar to Namibia. Directing his human subjects, and often waiting patiently for the animals, he took hundreds and hundreds of pictures, from which those in the show were selected. His ambition is to dissolve the boundaries between man and other species, between art and nature, between now and forever.

If you haven't heard of Colbert before, you're hardly alone. A New York City resident, he has never shown his work in a commercial gallery or U.S. museum but instead has been supported by private collectors, such as Paul Hawken, an entrepreneur, and Patrick Heiniger, the head of Rolex, which helped underwrite this show. (Colbert's photographs start at $180,000 and have been collected by Donna Karan, Laurence Fishburne and Brad Pitt.) For "Ashes and Snow," Colbert commissioned the Japanese architect Shigeru Ban to design a "nomadic museum." This remarkable 672-foot-long temporary structure—made of shipping containers, with trusses and heroic columns constructed of cardboard—was erected on a pier on the Hudson River in Manhattan.

Entering it is a little like going to church: it is darkly dramatic, with the photographs lit and suspended on wires, so they seem to float in the

Colbert has worked with zebras in Kenya (left) and with an eagle (below) at the mortuary temple of Queen Hatshepsut in Egypt.

Colbert's ambition is to dissolve boundaries between man and other species, between art and nature, between now and forever.

In a "bestiary" compiled over 13 years (a cheetah in Namibia), Colbert seeks to evoke "serenity and hope." But are the animals really photographed "on their own terms," as his show claims?

The artist himself appears—dancing with whales, swimming an underwater duet with a girl, looking priestlike in an ancient temple.

nave-like space. They are stunning as objects, both in their scale—about 6 by 9 feet—and in their soft patina. Printing on handmade Japanese paper, Colbert uses beeswax or pigment to create a sense of age—or perhaps agelessness. The artist, who doesn't wear a watch (not even a Rolex), says, "I work outside of time."

Critics, however, live in the temporal world, and "Ashes and Snow" has drawn fire from, among others, Roberta Smith of the *New York Times*, who called the exhibition "an exercise in conspicuous narcissism." Partly, she was provoked by a film that accompanies the show, which echoes the photographs but doesn't capture their haunting mood; it plays continuously in slow motion with a portentous voice-over by actor Fishburne. The ponytailed Colbert himself appears in several sequences—dancing with whales, swimming an underwater duet with a girl, looking priestlike in an ancient temple.

The public has embraced "Ashes and Snow," which has drawn more than 15,000 visitors a week since it opened in March. (The show closes June 6 but will open in December on the Santa Monica Pier near Los Angeles, and other venues abroad are planned, including the Vatican.) Colbert considers himself in the midst of a 30-year project and will keep adding to what he calls his "bestiary." Next on his itinerary: Borneo to photograph orangutans; Belize or Brazil for jaguars.

The most striking image in "Ashes and Snow" is unlike any other: an almost abstract close-up of an elephant's eye, bright and piercing, looking out from a mass of wrinkled skin. The human subjects in these photographs keep their eyes closed. Colbert, trying to level the field between man and beast, says he wondered "what it would be like to look out of an elephant's eye." "Ashes and Snow" is his answer. Now we wonder what the elephant would make of this elegantly stylized dream world.

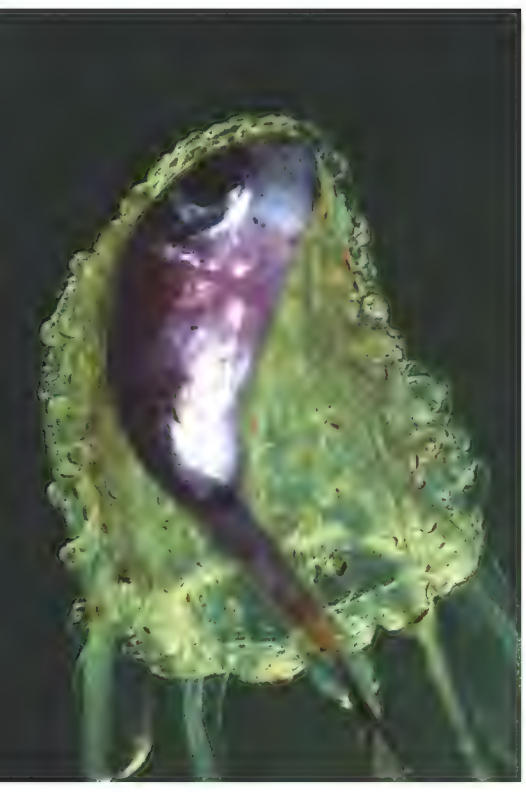
The title "Ashes and Snow" comes from the photographer's related novel, a year of daily letters from a voyager to his wife. Colbert, concerned about the future of wild animals, has said he hopes his photos (top and opposite, in Myanmar, and above, in Namibia) are not a "requiem" for "nature's living masterpieces."

CATHLEEN MCGUIGAN is a Newsweek *senior editor in charge of arts and entertainment.*

KILLERS IN PARADISE

THE TROPICS ARE HOME TO THE WORLD'S MOST VENOMOUS CREATURES—JELLYFISH WITH 4 BRAINS, 24 EYES AND STINGERS THAT CAN KILL YOU IN A MINUTE FLAT

BY PAUL RAFFAELE PHOTOGRAPHS BY PAUL SUTHERLAND



THE SKY IS AN IMMENSE bowl of blue and the boiling-hot sun speckles the flat green waters gold as our boat edges out of Port Douglas, Australia, just north of the tropical resort town of Cairns. On board, tourists from around the world are heading for the Great Barrier Reef, the world's largest natural structure—stretching for 1,400 miles along the continent's northeastern coastline.

After a 90-minute journey, we arrive at Opal Reef, a chunk of the Great Barrier Reef five miles long and three miles wide, where frothy white waves break gently over shadowy outcrops of coral as big as houses. We throw on our snorkeling gear and slip quickly into the water, drifting over the shallow reef facedown, entranced by the multihued coral—some resembling giant brains, others massed like stag horns and mammoth fans—and the neon-colored small fish that dart in and out. Not one of the crew members has bothered to warn us that Opal Reef is where one of the planet's deadliest creatures killed a visitor three years earlier.

Robert King, 44, from Columbus, Ohio, was snorkeling over the same underwater landscape

Danger lurks in tropical waters, where box jellyfish hunt for prey. Small species like *Carukia barnesi* (eating a fish, at left) usually leave humans sick but alive, although fatal stings from tiny box jellies have been reported near the Great Barrier Reef (above). Venom from the larger *Chironex fleckeri* (at right, passing less than a foot away from a posing fisherman) can stop the human heart in 60 seconds.

YANN ARTHUS-BERTRAND / CORBIS; DAVID WACHENFELD

when he felt a mild sting on his chest and came back onto the boat. Within 25 minutes his face flushed tomato-red as severe pain gripped his stomach, chest and back muscles. The skipper radioed for a medevac chopper, whose crew injected King with a massive dose of pethidine, an opiate-like painkiller, then winched him from the boat and rushed him to Cairns.

By the time he was wheeled into the emergency ward at Cairns Base Hospital, King's speech was slurred. He was put on a ventilator, as doctors pumped him full of painkillers while racing to save his life. A local zoologist, Jamie Seymour, was called in to take a scraping of the sting site. While he worked, Seymour noticed that King's blood pressure was spiking dramatically. King lost consciousness; then, Seymour says, "an artery or vein in his brain blew." Blood flooded King's brain tissues, and two days later he died.

After analyzing the shape and size of the stinging cells, which were about an inch long, Seymour blamed King's death on a nearly transparent jellyfish the size of a thumbnail. Covered from the top of its head to the tip of its four tentacles with millions of microscopic spring-loaded harpoons filled with venom, it's one of at least ten related species of small jellyfish whose sting can plunge victims into what doctors call the Irukandji syndrome. "The symptoms overwhelm you," says Seymour, 40, who himself was stung by an irukandji on the lip, the only part of his body uncovered as he scuba-dived looking for specimens near an island off Cairns in late 2003. "On a pain scale of 1 to 10, it rated between 15 and 20," he says, describing the vomiting, the cramps and the feeling of panic. "I was convinced I was going to die." But he was lucky; not all species of irukandji administer fatal stings, and he recovered within a day.

So far, only King's death—and perhaps that three months earlier of an Englishman, 58-year-old Richard Jordan, farther south on the Great Barrier Reef—can be attributed to irukandji venom, but Seymour cites research suggesting that because the symptoms may resemble strokes or decompression sickness, and can lead to drowning, countless more swimmers have probably fallen victim to Irukandji syndrome in offshore waters throughout the tropics. Stings from the irukandji species who live in waters closer to shore are rarely fatal but are still excruciatingly painful: for centuries before the tiny jellies were identified as the culprit, the local Aborigines at Cairns, the Irukandji tribe, knew that to swim in the shallows in the rainy season, from November to May, was to risk getting stung, although they didn't know by what.

More ominously for residents of North America, doctors at the U.S. Army Special Forces Underwater Operations School at Key West, Florida, have treated military divers suffering from symptoms similar to the syndrome; U.S. Navy divers have seen Irukandji-like jellyfish in the waters off Cuba's Guantánamo Bay; swimmers have been badly stung in Hawaii; and the Gulf of Mexico and the adjoining southern U.S. Atlantic coastline have seen an increase in people being sickened by stings that almost certainly come from an irukandji or a related jellyfish.

A box jelly swims through a tank under the watchful eyes of Australian zoologist Jamie Seymour, the world's leading authority on the creature, who was himself stung in 2003.

DAVID WACHENFELD

MOST JELLYFISH ARE PASSIVE; they drift up and down in the water column, or are pulled to and fro by the tides and winds. They float through the oceans devouring tiny fish and microscopic creatures that bumble into their tentacles, and are no threat to humans.

But those known as box jellyfish, for the shape of their bell, or body, are a breed apart. Also called cubozoans, they're voracious hunters, able to chase prey by moving forward—as well as up and down—at speeds of up to two knots. They range in size from the various irukandji species to their big brother, the brutish *Chironex fleckeri*, which has a bell the size of a man's head and up to 180 yards of tentacles, each lined with billions of cells bursting with deadly venom. Also known as a sea wasp or marine stinger, Chironex, which is far deadlier

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PAUL RAFFAELE, a veteran Australian journalist, covered the Korubo Indians of the Amazon Basin for the April 2005 issue. Photographer PAUL SUTHERLAND is based in Princeton.

than irukandji, boasts powerful stingers, or nematocysts, strong enough to pierce the carapace of a crab and quick enough to shoot out at the fastest speed known in the natural world—up to 40,000 times the force of gravity. And unlike other jellyfish, a box jellyfish can see where it's going and alter its course accordingly; like an eerie creature sprung from science fiction or a horror movie, it has four separate brains and 24 eyes, providing it a 360-degree view of its watery world.

"A *Chironex fleckeri* can kill a human in one minute flat," says Seymour, widely considered the world's foremost box jellyfish researcher. The most recent victim was a 7-year-old boy who died two years ago at a beach south of Cairns, becoming one of about a hundred people believed to have been killed over the past century by Chironex in Australia alone. (No one knows for sure how many swimmers have died from the stings of other box jellyfish outside Australia, but Seymour puts the number at "hundreds, possibly thousands.") Survivors, those lucky enough to have been gripped by less than the four yards of Chironex tentacle that can kill an adult (or the two yards it can take to kill a child), suffer pain that one has described as "like having a bucket of fire poured on me" and are branded by macabre tentacle marks, scarlet tangled wheals that make the victims look as if they'd just been lashed at the mast. "Chironex is by far the world's most venomous creature," says Seymour. "It makes venomous snakes look like amateurs."

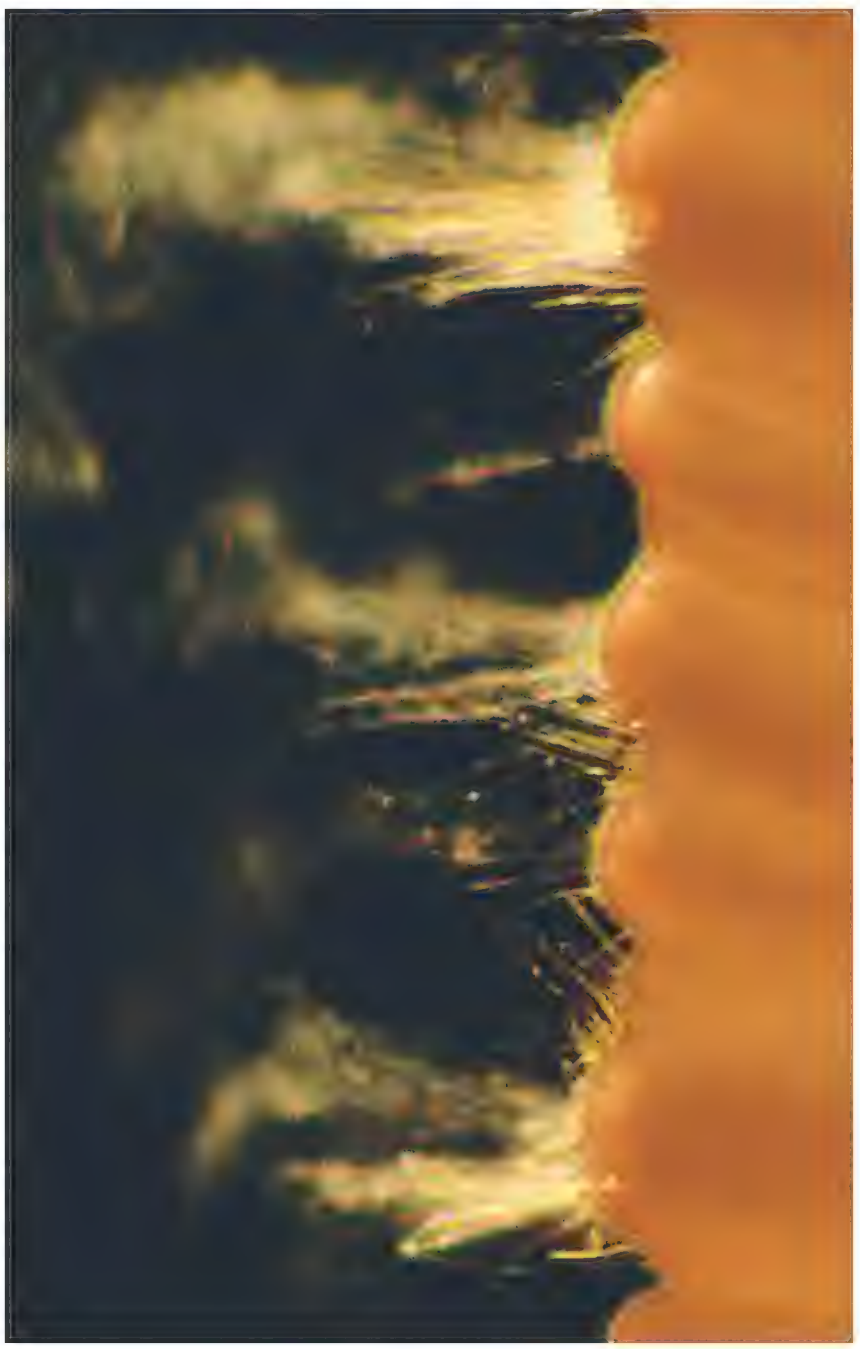
And it wreaks havoc with the November-to-May swimming season throughout northern Australia, where fear of it closes almost all of the beaches along the entire top half of the continent from Gladstone in the east to Exmouth in the west. At the few beaches that remain open, swimming areas are enclosed by netting that keeps out the deadly jellies, and lifeguards wear neck-to-ankle Lycra suits. Signs warn swimmers not to rub a sting, but instead to douse it in vinegar, which immediately kills any stinging cells not yet activated.

When the deaths of Robert King and Richard Jordan threatened to further dampen the multi-billion-dollar Great Barrier Reef tourism business, the Queensland state government swiftly set up the Irukandji Jellyfish Response Taskforce, made up of leading marine biologists, zoologists, toxin specialists, emergency-ward doctors and lifeguards, to begin to find out as much as possible about the tiny jellyfish. From her lab at James Cook University in Townsville, task force member Lisa-ann Gershwin, a 41-year-old California stockbroker-turned-jellyfish taxonomist, drives four hours north to Cairns each December to catch irukandji.

"We hardly know anything about their lifestyle, how they breed, where they come from, how fast they grow, how long they live, or even how many species there are," she says when I join her and a team of marine biologists at Palm Cove, an idyllic curve of tropical sea nudging pristine sand near Cairns and the site of more irukandji stings than any other beach along the northeastern coast. "But they're like other cubozoans: they're really neat, like aliens. They split from the other jellyfish, the scyphozoa, more than 300 million years ago, long before dinosaurs walked the earth, and have been making their own way along the evolutionary path ever since."

Gershwin and her team have gathered at Palm Cove for the annual irukandji bloom, when a huge number of the jellyfish swim or drift into waist-deep water by the beach to feed. On the day after Christmas, we pull on neoprene wet suits that cover us from toe to neck, put on rubber diver's booties and gloves, seal the wet suits around our wrists and ankles with duct tape, and wade into the water. There, we trudge back and

Venom puffs out from Chironex stingers, known as nematocysts. The virulent jellyfish has killed at least 100 people in the Australian tropics over the past century.



MIKE REAGAN; DAVID DOUBILET / NATIONAL GEOGRAPHIC IMAGE COLLECTION

forth in the shallows under the boiling summer sun, nets hooked to our shoulders like plow horses, to collect seawater in cylinders about the size of large soda bottles.

Hour after hour of sweaty torture produces only plankton, tiny larval fish and salps—invertebrates about half-an-inch long that tend to turn up in the shallows just before the irukandji bloom. Finally, at mid-evening, Gershwin pours the water from yet another cylinder into a transparent bowl. A few moments later she screams, "We've got one!" We rush to join her on the beach as she shines a flashlight on the bowl, revealing a jellybean-size box jelly known as *Carukia barnesi*, dangerous but usually not fatal. Head down, it swims purposefully around the bowl as if seeking escape, its ability to move unlike any other jellyfish I've ever seen before.

NO ONE EVEN KNEW what irukandji looked like in the 1950s, when a Cairns doctor, Jack Barnes, went searching for whatever it was that stung, and then sickened, hundreds of people at Queensland beaches each summer. Over several years, he tested on his own body the sting of every jellyfish he could collect from beaches in and around Cairns, but none produced the Irukandji syndrome. Then, one day in 1961, he found a tiny jellyfish of a kind he'd never seen before.

As a curious crowd gathered around him, he asked for volunteers to be stung. The first to step forward was his own 9-year-old son, Nick. "I said, 'Try it on me, Dad, try it on me,'" Nick recalled years later in an interview with the *Sydney Morning Herald Magazine*. "So, he ended up stinging me first, then himself, then a big local lifeguard called Chilla Ross."

The three returned to the Barnes family home where, 20 minutes after being stung on the beach, they began to feel the venom's terrifying effects. Chilla Ross began screaming, "Let me die." Nick remembers vomiting "as Dad carried me upstairs, then I was lying on a bed swallowing painkillers. I felt pretty terrible"—so terrible, in fact, that he found himself "thinking that dying mightn't be a bad idea." But he survived, as did Ross and his father. Three years later, Jack Barnes described the ordeal in the *Australian Medical Journal*, writing that all three of them had been "seized with a remarkable restlessness and were in constant movement, stamping about aimlessly, swinging their arms, flexing and extending their bodies, and generally twisting and writhing." In honor of Jack Barnes' discovery, the creature that stung

Up to his neck in protective Lycra, zoologist Jamie Seymour looks for Chironex in North Cairns. Swimmers stay within the red safety area, where netting keeps the killer jellyfish out.

I used to think turquoise was just a shade of blue. Then I saw a piece in an authentic Native American trading post. Turquoise wasn't just a shade of blue. It was a shade of passion. A shade of mystery. A shade of grace. I can't believe

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them was given the scientific name *Carukia barnesi*.

Ken Winkel, director of the Australian Venom Research Unit, has conducted experiments on anesthetized and ventilated piglets and concludes that *Carukia barnesi* venom "fires the sympathetic nerves, pushing up dramatically the blood pressure and heart rate. That's why you get sweating, nausea, anxiety and a feeling of doom"—the latter effect caused, Winkel believes, by the triggering of the stress hormones adrenaline and noradrenaline. In the body, noradrenaline produces a heart-thumping, throat-tightening, fight-or-flight effect. It's what you would feel, Winkel says, "if you were put in a cage with a hungry lion."

LATE LAST YEAR, AFTER TRACKING INDIVIDUAL JELLYFISH, JAMIE SEYMOUR STARTLED THE WORLD OF SCIENCE. CHIRONEX, HE SAID, SPENT SEVERAL HOURS A NIGHT SLEEPING.

Chironex venom, by contrast, attacks the heart directly, which can cause dramatic and rapid cardio-respiratory arrest, says Darwin-based professor Bart Currie, a specialist in treating Chironex victims. "A healthy heart contains millions of muscle cells that all beat to the same rhythm to pump blood through the body," he says. "For reasons we don't yet know, Chironex venom makes the heart cells beat irregularly. If enough venom is injected, the heart shuts down altogether."

Death comes quickly to Chironex victims because—unlike venomous snakes, which inject a glob of venom that must pass through the lymphatic system before draining into the rest of the body—Chironex shoots its venom into the bloodstream, giving the venom a direct pathway to the heart.

IN ADDITION to their stinging cells, box jellyfish have another superlative weapon in their hunt for prey: one of the world's most effective sets of eyes. On a windy day at a beach 40 miles north of Cairns, I help a team led by Dan Nilsson, a zoology professor at Sweden's Lund University and a renowned expert on animal eyes, in catching ten specimens of a box jelly about the size of a coffee cup. While the species, as yet unnamed, is less deadly than Chironex or the offshore species of irukandji, in 1990 its close relative *Chiropsalmus quadrumanus* stung to death a 4-year-old boy in the shallows of a beach near Galveston, Texas. *Chiropsalmus quadrumanus* has also been reported in the waters off North Carolina, Brazil, Venezuela and French Guiana.

Like the irukandji at Palm Cove, the jellyfish we capture skeeter around the bucket of seawater that Nilsson puts them in, carefully skirting its curved sides. "They swim like fish, not like jellyfish," he says with a smile. He plucks one from the bucket and shows me what keeps it from bumping into things: four tiny black dots, containing the jellyfish's 24 eyes, on strands connected to each side of the cube of jelly. Under the microscope, Nilsson has detected in each dot something he calls a sensory club, which is an organ with a set of six eyes, including four that are—much like the eyes of other jellyfish—simply pits, limited to detecting light intensity in various directions. But the two other eyes in each sensory club have more in common with human eyes than the eyes of other jellyfish, with lenses, corneas and retinas. One eye, which points obliquely downward at all times, even has a mobile pupil that opens and closes. The other major eye points upward. "We're not exactly sure what these eyes are doing," Nilsson says, although he believes they may help the jellyfish "position itself in the right place where there is plenty of food." They also help the animal situate the shoreline and the horizon—to avoid being dumped on the beach by a wave—and see obstacles that would tear its delicate tissue, such as a coral reef, a mangrove tree or a pier.

Nilsson has collected and studied the eyes of box jellyfish in other locations, such as mangrove swamps in Puerto Rico, and has found exactly the same set of 24 eyes in box jellyfish wherever he's gone. "They live in very different habitats," he says—"some in mangrove swamps, others in sandy beaches, some on

Bathers who venture to the few open beaches in northern Australia are well warned about Chironex, also known as marine stingers. Vinegar can help reduce a sting's effects.

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rocky shores, coral reefs and kelp forests. Exactly why they have the same eyes, we don't know."

They also have the same stomach—or, rather, stomachs. Because a box jelly, as Jamie Seymour puts it, "charges around the ocean all day hunting mobile prey, prawns and fish," its metabolic rate is ten times that of a drifting jellyfish. So, to swiftly access the energy it needs, the box jellyfish has developed a unique digestive system, with separate stomachs in each of its tentacles. All box jellies turn their food into a semi-digested broth in the bell, and then feed it down through the tentacles to be absorbed. Since a Chironex can have up to 60 tentacles, each as long as 3 yards, in effect it has up to 180 yards of stomach.

If box jellyfish eyes are a puzzle, its four primitive brains—positioned on each side of its body and attached to it by the same strand that anchors its eyes—are an enigma. Can the four separate brains communicate with each other? If so, do they merge the images they receive from the 24 eyes into one image? And how do they manage if different eyes detect radically different images? Nilsson shrugs. "They've evolved a rather advanced system unlike any other animal on earth," he says. "But we have no idea what's going on in their four brains, and I suspect it will be a long time before we find out."

Each of four black dots on a box jelly's bell contains six eyes, far more complex than those of other jellyfish. The eyes help the box jellyfish avoid obstacles as it pulsates through the water.

DAVID DOUBILET / NATIONAL GEOGRAPHIC IMAGE COLLECTION

SIX MONTHS AGO, after tagging Chironex in the wild with tiny ultrasonic transmitters that allow him to track an individual jellyfish for up to three weeks, Jamie Seymour made an announcement that startled his fellow scientists. "During daylight hours, from about six in the morning to three in the afternoon," he said, "they moved in straight-line distances of about 250 yards an hour. But from 3 p.m. to 6 a.m. the next morning, they moved an average of less than ten yards an hour."

Determined to see the phenomenon for himself, Seymour donned a wet suit and plunged into shallow water off a beach south of Cairns. There, he observed Chironex resting motionless on the seafloor, their bells not pulsating and their tentacles completely relaxed. When he shined lights on them, they rose, swam around for a short time, and then settled back on the seafloor. Sleeping!

"It makes a lot of sense for them to become inactive at night when they can't see their prey," says Seymour. "They decrease the energy used in locomotion and divert it to growth." But not all researchers accept that Chironex do, in fact, sleep. And because the box jellyfish brain is so radically and impossibly different from the makeup of all other brains on our planet, we may never know who is right.

While scientists struggle to untangle the biological secrets of box jellyfish, doctors are having increasing success in treating the damage they do to humans. An antivenin for Chironex stings—made from antibodies created in sheep that are injected with the venom—is now administered to victims in northern Australian hospitals. There is no antivenin yet for the Irukandji syndrome, but Lisa-ann Gershwin is edging toward an important breakthrough—the first-ever mass breeding of tiny box jellyfish in a lab, from specimens she caught at Palm Cove this year. So far she's managed to breed just a handful of the "up to a million" jellyfish that she says researchers like Ken Winkel need to develop an effective antivenin.

More promising for serious irukandji stings, at least in the short term, is a treatment being used in the Townsville Hospital's intensive care unit: the infusion of a solution of magnesium sulfate directly into a victim's veins. "We've seen it swiftly reduce, to safe levels, the hypertension, and it lessens the pain considerably," says Michael Corkeron, one of the unit's physicians. But, he cautions, "we still have more to learn, including the correct dosage, before magnesium becomes standard treatment."

So until a fail-safe cure is found, box jellyfish, from the tiny irukandji that killed Robert King to the huge Chironex, will continue to cause illness and death in tropical waters worldwide. Says Jamie Seymour: "All we can do is alert people to the danger, here in Australia and overseas, and make sure that anyone stung is treated as quickly as possible. Then it's in the lap of the gods."

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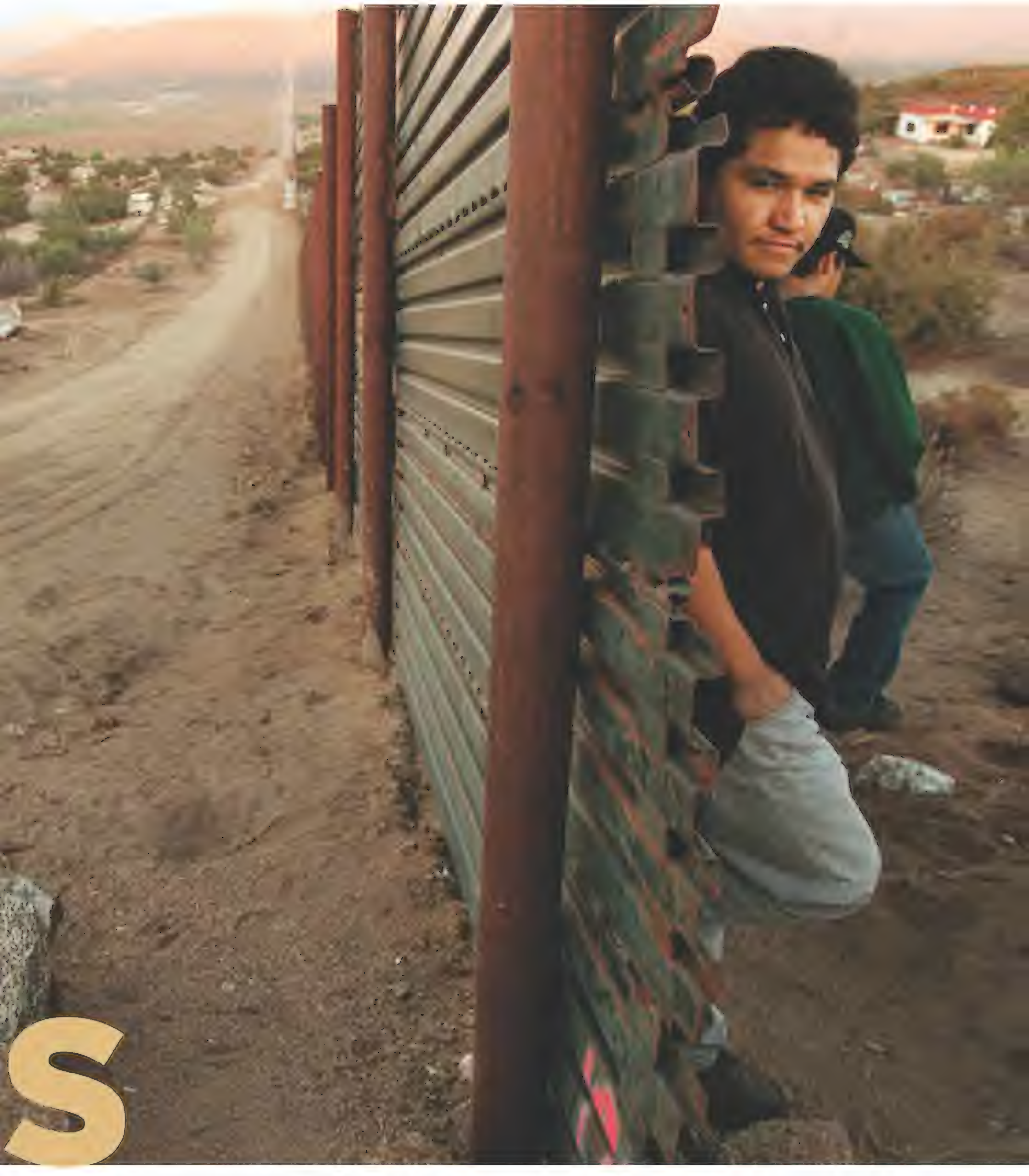
Increasingly prosperous in the U.S., Mexican immigrants (in New York City, celebrating Cinco de Mayo, above) are transforming life on both sides of the border. While tensions remain high over illegal crossings (a point on the California line, right) and the U.S. jobs immigrants are willing to take, some of the resentment is based on false assumptions.

MEXICAN IMMIGRANTS ARE DEFYING EXPECTATIONS IN THIS COUNTRY— AND CHANGING THE LANDSCAPE BACK HOME

BY JONATHAN KANDELL
PHOTOGRAPHS BY DANIEL BORRIS

CROSS PURPOSE



SAYS NEW JERSEY APPAREL MAGNATE JAIME LUCERO, WHO TODAY IS AN AMERICAN CITIZEN: "I CAME IN THROUGH THE BACKDOOR. BUT I NEVER INTENDED TO BE A BURDEN TO THIS COUNTRY."

ON A WINDY SUNDAY MORNING, I get off a subway train in Queens, New York, to join throngs of Mexican families headed into the mowed, shady groves of Flushing Meadows Park. Many are wrapped in Mexico's red, white and green national flag; others wear shawls imprinted with the image of the Virgin Mary. They have come, by the hundreds of thousands, to celebrate Cinco de Mayo (the fifth of May), the Mexican national holiday marking the day an invading French Army was defeated in 1862.

Inside the park, a steel globe of the earth and water-stained concrete pavilions, left over from the 1964 world's fair, suggest the ruins of a bygone civilization. On a stage just beyond these structures, costumed dancers and drummers evoke another lost civilization—the Aztec Empire. Following their performance, more contemporary acts predominate: mariachi musicians, cowboy balladeers, tropical torch singers, rock bands and comedians.

Between acts, radio talk-show hosts pay homage to the various states constituting the Republic of Mexico. The cheers of the crowd reach earsplitting decibels at the mention of Puebla, the small, 13,187-square-mile state (roughly the size of Maryland) due east of Mexico City. Little wonder, considering that Poblanos, as natives of Puebla are called, account for at least 80 percent of the estimated 600,000 Mexicans living in the New York City metropolitan region. And this is, in a sense, their day; the 1862 defeat of the French invaders took place in Puebla.

Nowadays, of course, it's the Mexicans who are often portrayed as invaders, illegal immigrants pouring across the 1,951-mile-long border with the United States. In fact, the presence of undocumented Mexicans, who account for perhaps 60 percent of the 12 million or so foreigners living illegally in this country and for 15 percent of the 2.1 million Latinos in New York City, remains the most contentious issue between the United States and its southern neighbor. For decades, undocumented Mexicans have taken the jobs that nobody else seemed to want, while fending off charges they were not only depriving Americans of gainful employment but were also lowering the wage for some blue-collar jobs.

The surprising reality, however, is that Mexico's immigrants—a population exemplified by the half-million or so Poblanos living in the New York area, with another 500,000 concentrated mainly in Los Angeles, Houston and Chicago—fuel a complex economic dynamic, both here and at home. In taking on menial work in this country, Mexicans have not only raised their standard of living and that of their families, they've also created a flow of capital back to villages across Mexico, es-

JONATHAN KANDELL reports frequently on economics and culture. Photographer DANIEL BORRIS is based in San Antonio.

P. 90 CATHERINE KARNOW / CORBIS; P. 91 SUSAN STERNER / AP / WIDE WORLD PHOTOS

pecially towns throughout Puebla. That transfer of wealth—around $17 billion last year, double what it was only four years ago—has transformed life across the border, where new housing, medical clinics and schools are under construction. "Many government officials both in the United States and Mexico would argue that these remittances have accomplished what foreign aid and local public investment failed to do," says Oscar Chacón, director of Enlaces América, a Chicago-based advocacy group for Latin American immigrants. As this transformation has taken place, many of the assumptions—or even stereotypes—held in this country regarding Mexican immigrants are being challenged.

"GETTING INTO THE U.S. was so much simpler and safer when I first came here," says Jaime Lucero, 48, one of the organizers of the Cinco de Mayo festivities. Lucero, from the small Puebla community of Piaxtla, was 17 when, in 1975, he waded across the Rio Grande into Texas and hopped a bus to New York City to join an older brother washing dishes in a Queens restaurant. He became legal under President Reagan's 1986 amnesty program, which granted residency to illegals who had resided in the U.S. before 1982 and imposed sanctions on employers who hired undocumented workers. He became a citizen in 1988. Today, he is the millionaire owner of both a women's apparel company in New Jersey and a factory in Puebla. "I came in through the backdoor," he says. "But I never intended to be a burden to this country."

Neither do Ricardo, 20, and Adela, 19 (as illegals, neither offers a surname), a couple I meet at a taco stand during the Cinco de Mayo festivities. They each work, they tell me, some 70 hours a week for less than the current $5.15 minimum hourly wage. Ricardo bundles and sells flowers at a delicatessen, while Adela washes, dries and folds clothes at a laundry. Both come from Chinatlán, the village nearest to Piaxtla. In the summer of 2003, they smuggled themselves across the border in a truck container, walked for several days through the 120-degree-heat of Arizona's Sonoran Desert, then took a series of cars and vans to New York City.

Last year, 154 Mexicans died from thirst and heat prostration between Tucson and Yuma not far from the place Ricardo and Adela entered the United States. But they both scoff when I ask if they feared for their lives. "I'm likelier to get run over by a car in Puebla," says Ricardo. The next time Adela crosses the border, she says, "it won't be so hot": she's planning a trip to Chinatlán for Christmas and a return to New York City a month later. Nor is she dissuaded by a more aggressive police presence at the border, the result of post-9/11 fears of terrorists sneaking into the United States. During the six months that ended April 1, 2004, the U.S. Border Patrol intercepted 660,390 people illegally crossing from Mexico—up 30 percent over the same period a year before.

In January 2004, President Bush proposed granting three-year visas to illegal foreigners who can show they hold U.S. jobs that Americans have turned down. The plan, now stalled in Congress, falls short of the permanent residence permits for immigrants that Mexican president Vicente Fox has been urging since 2001. President Bush's proposal bears a resemblance to the Bracero (migrant farmworker) Program of 1942 to 1964, which allowed Mexicans to be given temporary contracts for agricultural work. Intended to address a World War II-era shortage of farm labor, the Bracero Program led to an unintended consequence: an upsurge in illegal border crossings. Millions of Mexicans—precise figures have never been calculated—entered the country illegally. "People who were unable to get bracero jobs just headed elsewhere in the United States," says Robert Courtney Smith, a sociology professor at the City University of New York (CUNY) and author of

Poblanos, emigrants from the state of Puebla (map, above), a region of picturesque villages (Piaxtla, right), are fueling a transfer of wealth. Sending remittances from places such as Queens, New York (opposite, far left), Poblanos are revitalizing their towns (in Tulcingo, left, roofs sprout satellite dishes).

MAP: MIKE REAGAN

a forthcoming book on Puebla immigrants in New York. The first Poblanos to arrive in New York during the 1940s, he says, ended up in the city for this reason.

Once settled, the new arrivals often arranged menial jobs, and a place to sleep, for friends and relatives, most of them also illegal, who joined them from their hometowns in Puebla. Over the past six decades, the number of illegal Poblanos in New York has soared. But according to Francisco Rivera-Batíz, a Columbia University professor of economics and education, until the early 1990s, some 85 percent of all undocumented Mexicans in New York City returned home within five years. That figure, he says, has declined sharply in recent years to about 50 percent because of Mexico's sluggish economy—and, ironically, because stricter border surveillance makes going back and forth between the two countries more difficult. As a result, the border controls that were designed to keep people out of the United States are also keeping illegals *in*.

Yet many Poblanos in the United States illegally are willing to risk apprehension; for those here legally, of course, visiting Mexico and reentering the United States poses few problems. "People from my hometown are constantly going back and forth," says Jesús Pérez Méndez, who was born in Tulcingo de Valle, Puebla, and is now an academic adviser at CUNY. Poblanos finance their round trips by acting as couriers, or *paqueteros*, for clothes, electronic goods and other gifts sent by immigrants to relatives in Puebla. Between visits to their villages, Poblanos keep in touch through discount phone cards, e-mail or Web sites. It was after listening to a live Internet radio broadcast on tulcingo.com that I decided to fly to Mexico to assess the effects of this symbiotic relationship for myself.

Emigration threatens traditional artisanry (such as mask-making). Says ceramist César Torres: "Young people aren't willing to work for something badly paid."

THE SIERRA MIXTECA, a mountain chain, stretches across the southern portion of the state of Puebla. For much of the year, the region is hot and arid, with yellow grass blanketing farm plots and giant organ cactus spiking the hillsides. But I arrive in June, during the rainy season. In the morning mist, the mountains appear almost tropically lush, their buttes and crags cloaked in green. Dry riverbeds have roared back to life. Purple-blossomed jacaranda and red-flowered colorín trees adorn the roadsides, while bananas and mangos ripen in backyard orchards. Fat goats and cattle waddle onto the highway, forcing drivers to brake and lean on their horns. Turkey vultures circle overhead, looking for roadkill—dogs, armadillos and especially iguanas.

But the Sierra Mixteca has also undergone dramatic transformations that have nothing to do with rain. In Piaxtla, most of the 1,600 inhabitants are either children or older adults. "Maybe three out of four of my constituents live in New York," says Manuel Aquino Carrera, the town's mayor. The cash they send home each month can be seen in new brick houses with satellite television dishes on their roofs. "As a child, I could count on my fingers the houses that were made of brick and concrete," says Aquino, 40. "Everything else was palm-thatched adobe." Many of the new houses sit empty, occupied only during summer months or at Christmas.

Efforts to create jobs that might keep younger adults in the Sierra Mixteca have largely foundered. In 2001, Jaime Lucero, the New Jersey-based clothing magnate and Piaxtla's most illustrious son, opened a factory in the Puebla town of El Seco; the facility employs more than 2,500 workers. He planned to open five more plants, but says he hasn't been able to do so. "So many young people have emigrated," he says, "that there isn't enough labor to set up another plant."

Emigration has also hit Puebla's long tradition of artisanry—ceramics, woodwork and weaving. Folk art pieces are increasingly mass-produced, and master craftsmen despair of passing on their skills. "Most young people aren't willing to work the long, lonely hours, and for something that with few exceptions is badly paid," says César Torres Ramírez, 52, one of Puebla's leading ceramists. Although his exquisitely glazed plates and vases—embellished with feathery blue patterns and animal motifs—win national awards, to make a living Torres must work from dawn to sunset six days a week in a small home studio.

"These master artisans are an endangered species," says Marta Turok Wallace, a Mexico City anthropologist who runs Amacup, a cooperative that connects Mexican artisans with collectors, interior designers and retailers. Turok and her colleagues try to locate and encourage younger artists, such as Rafael Lopez Jiménez, 20, a mask-maker in Acatlán de Osorio, a 45-minute drive east of Piaxtla.

Lopez is self-taught in a profession that tends to be handed down from one generation to the next through long apprenticeships. His grandfather, Efrén Jiménez Ariza, sculpted wooden jaguar masks but failed to interest his own children in the craft. Lopez was only 6 when his grandfather died, but as a teenager, he was drawn to his work. "Fortunately, some of his masks and most of his tools survived," says Lopez, who, like his grandfather, uses the soft, durable wood of the colorín tree.

As elsewhere in Mexico, the craft of mask-making survived thanks to Spanish missionaries who adapted it to Roman Catholic iconography. Jaguar masks "are associated with ancient Indian rituals asking the gods for rain around the time of the planting of corn," says anthropologist Turok. And Puebla is one of the earliest sites of corn cultivation. In 1960, the late American archaeologist Richard S. MacNeish, excavating in

Puebla's arid Tehuacán Valley, uncovered ancient corncobs 4,000 years old.

Farming in the Tehuacán Valley began to take off only around 1800 B.C., when yields reached 100 pounds of corn per acre, says University of Michigan anthropologist Kent Flannery, who was a graduate student on the MacNeish expedition. The development of a complex irrigation system—based on the channeling of water from subterranean mineral springs—was essential to bringing about this advance. University of Texas anthropologist James Neeley, who is also a MacNeish expedition alumnus, has demonstrated that the ancients used gravity to channel the water from the springs, which lie at the northern end of the Tehuacán Valley, down small, winding troughs to the lower end of the valley.

But if the ancient Poblanos were able to master corn cultivation and make it the foundation of their lives, their modern-day descendants must struggle against price controls that the government began to impose in the early 1980s to keep tortillas cheap. In addition, since the advent of the North American Free Trade Agreement (NAFTA) in 1994, Poblano farmers have been unable to compete with imports of new corn hybrids, produced by high-tech, low-cost U.S. farms. All along the highway connecting Piaxtla with Tulcingo 30 miles to the south, cornfields lie fallow, even at the height of the growing season. The gradual demise of small-scale farming here has also fueled emigration to the United States.

Herminio García says he saw the collapse coming more than 30 years ago. He left his family's failing farm in Piaxtla and crossed the U.S. border in 1971. After a succession of factory jobs, García did "what I knew best"—he went into the tortilla business. Today he holds dual U.S.-Mexican citizenship, and his Tortilleria La Poblanita factory in Yonkers, a gritty northern suburb of New York City, employs 27 Poblanos, half a dozen of them from Piaxtla. Mounds of corn dough are fed into a machine that turns them into flat patties; they move by conveyor belts into an oven and then a cooler. At the end of each workday, 648,000 tortillas are shipped to supermarkets, delis and restaurants across the Northeast.

García, 62, lives with his family in a New Jersey suburb. But as retirement nears, his thoughts turn more and more to Piaxtla and the house he built there on his ancestral property, which he visits a half-dozen times a year. "I'm still a farm boy," he says. "I know how to plow with an ox, fix fences and weave palm leaves into a hat." What he recalls most fondly is herding goats. As a child, he would take the animals to graze in the hills hours before dawn, carrying a kerosene lamp to

Most of Piaxtla's 1,600 inhabitants are children or older adults. According to the town's mayor, Manuel Aquino, "maybe three out of four of my constituents live in New York."

read his school lessons aloud: "Neighbors would hear me and say, 'There goes Herminio—he's as crazy as his goats.'"

THE TOWN OF TULCINGO DE VALLE is a 40-minute drive south of Piaxtla. Its 8,000 residents have thus far resisted New York City's temptations only slightly more successfully than those in Piaxtla, though the money returned to Tulcingo's coffers by its emigrants has helped restore the town church, damaged in an earthquake in 1999, and caused the Hong Kong and Shanghai Banking Corporation, a global financial giant, to open a branch here. Remittances have been invested in restaurants and cybercafés that have replaced *pulquerías*, old-time saloons with swinging doors.

Signs of newfound affluence are everywhere. There are dozens of taxis—though the town can be traversed on foot in less than 20 minutes—and repair shops of all types, for cars, bicycles, television sets and stereos, have sprouted like cactuses. Video games are so popular that parents complain their kids have given up sports and grown too sedentary. Main streets have been asphalted.

The night of my arrival, David Bravo Sierra, 53, owner of MacD, a spacious pizza and hamburger restaurant on the main street, hosts a dinner attended by a dozen friends. In the 1950s, Bravo's father picked asparagus in California. The son migrated to New York City in 1972, shared a one-room apartment with several other Tulcingo immigrants, and worked alongside them as a dishwasher in a Manhattan restaurant. ("You got three meals a day free and you could spend whatever you made on housing and remittances [to send home]," he says.) He earned a few extra dollars playing lead guitar for a Latin band—"The first band from Puebla in New York," he claims. Bravo returned to Tulcingo in 1990. Now, his oldest daughter, who holds dual citizenship, lives in New York City and travels legally to Tulcingo, paying her way as a paquetera.

Of the dozen dinner guests I met that night at MacD, about half have lived in the United States. Radio journalist Elsa Farcier, in her early 20s, has never been north of the border. I had heard her, on an Internet radio broadcast in New York City, interviewing 60-something Fernando Flores about 1950s courting rituals at a no-longer-celebrated festival known as a *kermes*. Farcier told me she was trying to reacquaint Tulcingo residents in New York City with their traditional roots. "Young people here never saw a kermes, so it was new to them as well," she says.

ON MY LAST DAY in the Sierra Mixteca, I drive back to Piaxtla to meet with a man who reputedly arranges to smuggle people across the border. Often called "coyotes," most smugglers prefer the term *pollero*—someone who guards chickens. My instructions are to wait for him at the edge of the weekly street market next to a folk healer's stand.

The healer, Cobita Macedo, hawks herbal cures, some of them handed over the centuries. For kidney disease, she offers a gnarled clump of dried flower that, she explains, must be boiled in water. "You drink a cup of the broth twice a day, and you will pass any kidney stone within weeks," she promises. Other herbal concoctions, she says, treat gastrointestinal, pulmonary and heart ailments. But in recent years, she adds, the most sought-after remedies have been for hypertension and diabetes—illnesses associated with the more stressful lifestyles (and eating habits) of expatriate Poblanos.

When the reputed pollero, a slim man in his 40s, at last shows up, he suggests we have breakfast in the market, where local farmers have set up scores of stands selling all manner of fruits, vegetables and freshly prepared foods. We share a plate of *barbacoa*—kid goat that has been barbecued in an underground pit and served with chile sauce, cilantro and roasted scallions, wrapped in freshly made tortillas.

In the Mexican and U.S. media, coyotes are routinely and adamantly denounced for trafficking in human lives. But my breakfast companion claims that "most people think my profession is a necessary and honorable one. They entrust me with their sons and daughters and friends." (He also says that while his vocation is widely known, he has never been bothered by the police.) His job, as he describes it, is to escort the departees to the border and there turn them over to someone who will smuggle them into the United States and arrange for transportation to their ultimate destination—usually New York City. His fees range from a rock-bottom 1,800 pesos ($160) for Poblanos who want only to get across the border, to 10,000 pesos ($900) for door-to-door shepherding, including airfare, from Piaxtla to New York City.

As I sit with him, I recall my dinner at MacD, at which Jaime Peñafort, 26, talked of having paid the cheapest rate to be smuggled across the border, led on foot across the Arizona desert, and then driven in stages to Houston, where he worked as a dishwasher for more than a year. "Each leg of the trip requires paying somebody hundreds more pesos," said Peñafort, who now runs a tortilla business in Tulcingo. "You feel like you're getting sold over and over again."

Piaxtla's mayor, Manuel Aquino, says he has not once contemplated making that hazardous crossing. He decided a long time ago, he tells me, never to try to enter the United States illegally. His father, a farmer, insisted that all seven of his children take up professions and remain in Mexico, which every one of them did, unlike most of the mayor's friends and neighbors. But once elected mayor, Aquino says, he felt a duty to go to New York City to meet with constituents. Two years ago he applied for a tourist visa, giving his reasons to American consulate officials. "And," says Aquino with a slow smile, "they turned me down."

Opposite, clockwise from top left: Herminio García (at his Yonkers, New York, tortilla factory) wants to retire to Puebla—and his goats. Piaxtla's mayor Aquino (with constituents) couldn't get a visa for the U.S. David Bravo (at his Tulcingo restaurant) learned his trade as a dishwasher in Manhattan. Folk healer Cobita Macedo (at her Piaxtla stand) treats more hypertension and diabetes.

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KING TUT

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BY RICHARD COVINGTON

The gold funerary mask (opposite) that adorned the head and shoulders of Tutankhamun's mummy was deemed too fragile to travel for the current show. In all, more than 5,000 artifacts were unearthed from Tut's tomb, including a gilded wood funerary figure, or *shabti*, of the king (above, left) and a carved and painted calcite canopic stopper (above, right). The wooden head of a bovine goddess (above, center) was buried with Amenhotep II, an ancestor of Tut's who ruled from 1427 to 1401 B.C.

ANDREAS F. VOEGELIN / ANTIKENMUSEUM BASEL UND SAMMLUNG LUDWIG / SUPREME COUNCIL OF ANTIQUITIES, CAIRO (3). P. 98 GRANGER COLLECTION, NEW YORK

A wooden shrine from Tutankhamun's tomb was sheathed in gold leaf and embossed with images of the king and his wife, Ankhesenamun, who in one scene (above) hands her husband an arrow to shoot at ducks. Opposite: Recent CT scans—full body (right) and skull (far right, top)—of Tut's 3,300-year-old mummy (far right, bottom: a facsimile in Cairo) show an elongated head and good teeth. The scans also indicate that though Tut may have suffered a fractured left thighbone, he was not, as some have speculated, killed by a blow to the head.

SEATED ON A CUSHION at the Pharaoh Tutankhamun's feet, Ankhesenamun hands her young husband an arrow to shoot at ducks in a papyrus thicket. Delicately engraved on a gilt shrine, it's a scene (above) of touching intimacy, a window into the lives of the ancient Egyptian monarchs who reigned more than 3,300 years ago. Unfortunately, the window closes fast. Despite recent findings indicating that Tut, as he has come to be known, was probably not murdered, the life and death of the celebrated boy-king remain a tantalizing mystery.

"The problem with Tutankhamun is that you have an embarrassment of riches of objects, but when you get down to the historical documents and what we actually know, there is very little," says Kathlyn Cooney, a Stanford University Egyptologist and one of the curators of the first Tutankhamun exhibition to visit the United States in more than a quarter-century. (The show opens at the Los Angeles County Museum of Art on June 16 and travels to the Museum of Art in Fort Lauderdale, the Field Museum of Natural History in Chicago and the Franklin Institute in Philadelphia.)

On display are 50 stunning funerary objects from the pharaoh's tomb and 70 pieces from other ancient tombs and temples, dating from 1550 to 1305 B.C. On loan from the Egyptian National Museum in Cairo, this astonishingly well-preserved assemblage includes jewelry, furniture and exquisitely carved and painted cosmetics vessels.

Negotiations for the exhibition dragged on for three years while the Egyptian Parliament and many archaeologists resisted lifting a travel ban imposed in 1982 after a gilt goddess from Tut's tomb was broken while on tour in Germany. In the end, Egypt's president, Hosni Mubarak, intervened.

"Once the president decided to put Egypt's collections back on the museum circuit, we obtained the green light for the project," says Wenzel Jacob, director of the Kunst- und Ausstellungshalle museum in Bonn, Germany, where the exhibition was on display before moving to Los Angeles.

Most of the objects were excavated in the Valley of the Kings, two desert canyons on the west bank of the Nile, 416 miles south of Cairo. Covering half a square mile, the valley is the site of some 62 tombs of Egyptian pharaohs and nobles. Unlike the blockbuster show of the 1970s that fo-

RICHARD COVINGTON writes on history and art from his home in France. His article on Alexander the Great ran in November 2004.

BRIDGEMAN ART LIBRARY; P. 101 SUPREME COUNCIL OF ANTIQUITIES, CAIRO / AP/ WIDE WORLD PHOTOS (2); ART ARCHIVE

cused exclusively on Tut and the discovery of his tomb by English archaeologist Howard Carter in 1922, the current exhibition also highlights the ruler's illustrious ancestors.

"This period was like a fantastic play with magnificent actors and actresses," says Zahi Hawass, secretary general of Egypt's Supreme Council of Antiquities. "Look at the beautiful Nefertiti and her six daughters; King Tut married one of them. Look at her husband, the heretic monarch Akhenaten; his domineering father, Amenhotep III; and his powerful mother, Queen Tiye. Look at the people around them: Maya, the treasurer; Ay, the power behind the throne; and Horemheb, the ruthless general."

More than 30 golden statuettes of Tutankhamun and various dieties were found in the young king's tomb, among them a gilded wooden figure of the ruler as the King of Lower Egypt (right). Other treasures include a mirror case in the shape of an ankh (far right, top), the hieroglyphic for "life," and a gold pectoral (far right, bottom), inlaid with semiprecious stones that form a picture puzzle of Tut's ruling name, Nebkheprure.

Born circa 1341 B.C., most likely in Akhetaten (present-day Tell el-Amarna), Tutankhamun was first called Tutankhaten, a name that meant "the living image of the Aten," the sole official divinity by the end of the rule of Akhenaten (1353 to 1335 B.C.). Tut was probably Akhenaten's son by Kiya, a secondary wife, but may have been the son of Amenhotep III and Queen Tiye, making him Akhenaten's younger brother.

While Tut was being educated at the palace, the empire was losing its grip on its northern territories in what is now Syria. But there is no indication that Akhenaten, perhaps reluctant to send his troops to foreign fields while he attempted to recast the established religion, took any action against invading Hittite warriors from Anatolia.

Although little is known of Tut's childhood, British historian Paul Johnson speculates that life in a new capital city, Amarna, must have been insular and claustrophobic. Five or six years before Tut's birth, Akhenaten had created Amarna, in part, perhaps, to escape the bubonic plague that was ravaging Egypt's congested cities as well as to make a clean break with the cult of Amun, then Thebes' chief god. Declaring Aten as the supreme and only god, Akhenaten closed the temples of rival gods and had his soldiers deface images of Amun and other deities, tossing out, to widespread consternation, a system that for two millennia had brought stability to this world and promised eternal life in the next. "The [new] religion was followed only in Amarna," says André Wiese, curator of the Antikenmuseum in Basel, Switzerland, where the exhibition originated. "In Memphis and elsewhere, people continued to worship the pantheon of old."

After Akhenaten's death, a scramble for the throne ensued. A mysterious pharaoh named Smenkhkare may have become king and reigned for a year or two before dying himself. (It's also possible that he was a co-ruler along with Akhenaten and predeceased him.)

As the child husband of Akhenaten's third daughter, Ankhesenpaaten (who may also have been his half sister), Tut inherited the crown circa 1332 B.C., when he was 8 or 9 years old (about the same age as his bride). The couple were probably married in order to legitimize the boy's claim to rule.

Although Egypt, a superpower with a population of 1 million to 1.5 million, commanded territory stretching from Sudan almost to the Euphrates River, the empire under Akhenaten, "had crumpled up like a pricked balloon," according to Howard Carter in his 1923 book on the discovery of Tut's tomb. Merchants railed at the lack of foreign trade, and the military, "condemned to a mortified inaction, were seething with discontent." Farmers, laborers and the general populace, grieving the loss of their old gods, "were changing slowly from bewilderment to active resentment at the new heaven and new earth that had been decreed for them."

Carter believed that Akhenaten's wily adviser, Ay (who may have been Nefertiti's father), was responsible for installing Tut as a puppet pharaoh as a way to heal the divided country. When Tut and his wife were both about 11, Ay moved the court back to the administrative capital of Memphis, 15 miles south of today's Cairo, and likely advised the boy-king to reinstate polytheism. Tut obliged and changed his name to Tutankhamun ("living image of the Amun"); his wife became Ankhesenamun ("she lives for Amun").

Outside the Amun temple in Karnak, Tut erected an eight-foot-tall stela as an apology for Akhenaten's actions and a boast of all Tut had done for the Egyptian people. "The temples . . . had gone to pieces, the shrines were desolate and overgrown with weeds," the stela proclaimed. But the pharaoh now has "filled [the temple priests'] workshops with male and female slaves" and all "the property of the temples has been doubled, tripled, quadrupled in silver, gold, lapis lazuli, turquoise . . . without limit to any good thing."

As Carter's examination of Tut's mummy revealed, the young ruler stood about 5 feet 6 inches tall. Like his ancestors, says Hawass, he was probably raised as a warrior. (His tomb contained six chariots, some 50 bows, two swords, eight shields, two daggers and assorted slingshots and boomerang-like throw-sticks.) Scenes on a wooden chest found in his tomb depict him riding into battle with drawn bow and arrow, trampling hordes of Nubian infantry under the wheels of his chariot. W. Raymond Johnson of the University of Chicago says Hittite texts recount an Egyptian attack on Kadesh, in today's Syria, shortly before the king's death. Tutankhamun "may actually have led the charge," he says. But other scholars, including Carter, view the militaristic images as polite fictions or propaganda, and doubt that the monarch himself ever saw combat.

Most probably, the royal couple spent much of their time in Memphis, with frequent trips to a hunting villa near the Great Sphinx at Giza and to the temples of Thebes to preside over religious festivals. The teenage queen apparently suffered two failed pregnancies: the miscarriage of a 5-

P. 103 ANDREAS F. VOEGELIN / ANTIKENMUSEUM BASEL UND SAMMLUNG LUDWIG / SUPREME COUNCIL OF ANTIQUITIES, CAIRO (3)

month-old female fetus and a stillborn baby girl. (Both were mummified and buried in Tutankhamun's tomb.)

Then, around 1323 B.C., Tut suddenly died. According to the recent computed tomography (CT) scans, he was 18 to 20 years old at the time of death (judging from bone development and observations that his wisdom teeth had not grown in and his skull had not fully closed). Despite the fact that Carter's team had badly mangled the mummy, the scans indicate that Tutankhamun had been in general good health. He may, however, have succumbed to an infection due to a badly broken left thighbone. "If he really did break his leg so dramatically," Cooney points out, "the chances of him dying from it are reasonably high." But some members of the scanning team maintain that Carter and his excavators fractured the leg unwrapping the mummy; such a ragged split, had it occurred while Tut was still alive, they argue, would have generated a hemorrhage that would have shown up on the scans.

One theory that appears to have been finally put to rest is that Tut was killed by a blow to the head. A bone fragment detected in his skull during a 1968 X-ray was caused not by a blow, but by the embalmers or by Carter's rough treatment. Had Tut been bludgeoned to death, the scanning report found, the chip would have stuck in the embalming fluids during burial preparations.

After Tut's death, his widowed queen, many scholars believe, wrote in desperation to the enemy Hittite chieftain, Suppiluliuma, urging that he send one of his sons to marry her and thereby become pharaoh. (Some scholars, however, think that the letter may have been written by Nefertiti or Tiye.) Since no Egyptian queen had ever married a foreigner, writing the letter was a gutsy move. The Hittites were threatening the empire, and such a marriage would have averted an attack as well as preserving Ankhesenamun's influence. After dispatching an envoy to make sure the request was not a trap, Suppiluliuma sent his son Zananza. But despite the chieftain's precaution, Zananza was killed on his way to Memphis, perhaps by general Horemheb's forces.

HOW DID TUTANKHAMUN escape the fate of so many pharaohs, whose graves were ransacked within a few generations of their death? For one thing, he was buried in a relatively small tomb. During his lifetime, work was under way on a grand royal tomb with long corridors and several rooms leading to a burial chamber. Perhaps because it was still unfinished at the time of his early death, the young king was buried in a much smaller crypt, possibly one meant for Ay.

After Tut's funeral, the elderly vizier married Ankhsenamun and became pharaoh. Dying three or four years later, some suggest at Horemheb's hand, Ay was buried in the large tomb that may have been meant for Tut. In 1319 B.C. the ambitious Horemheb seized power and immediately set about wiping Tutankhamun's name from the official records, in all likelihood, Cooney speculates, so that Horemheb himself "could take credit for restoring stability." Then, nearly 200 years after Tut's death, his tomb was covered over by huts of laborers digging a crypt for Ramses VI. As a consequence, the pharaoh lay buried and forgotten in an unmarked grave, largely safe from potential plunderers.

The boy-king's obscurity, however, came to an end on the morning of November 4, 1922, when a water boy with Carter's archaeological team dug a hole for his water jar and exposed what turned out to be the first step of Tut's long-lost grave. Despite Horemheb's efforts to erase Tut from history, excavations in the early 20th century had uncovered seal

Howard Carter discovered Tut's tomb in the Valley of the Kings (below, right) in 1922, but it took him three years to reach the ruler's innermost coffin (below). "The youthful Pharaoh was before us at last," he wrote. "An obscure and ephemeral ruler . . . had reentered . . . the world of reality and history!"

GRANGER COLLECTION; GRIFFITH INSTITUTE / HOWARD CARTER ARCHIVES

KENNETH GARRETT / FROM TUTANKHAMUN AND THE GOLDEN AGE OF THE PHARAOHS, NATIONAL GEOGRAPHIC SOCIETY (WASHINGTON, DC) 2005; ANDREAS F. VOEGELIN / ANTIKENMUSEUM BASEL UND SAMMLUNG LUDWIG / SUPREME COUNCIL OF ANTIQUITIES, CAIRO

A falcon-headed statue (left) representing Herwer, one of the gods of the traditional Egyptian religion that Tut restored, was found in the king's tomb. A life-size wooden torso of Tut (right) may have been used as a mannequin for holding royal garments and may also have served as a sculptor's model or ritual object.

impressions inscribed with his name. Carter had spent five years futilely searching for Tut's tomb, and his English patron, Lord Carnarvon, was ready to withdraw financing.

Soon after the water boy's discovery, the 48-year-old Carter arrived at the site to find the men working feverishly. By dusk the next day, they had hollowed out a passage 10 feet high by 6 feet wide, descending 12 steps to a doorway, which was closed off with plastered stone blocks. "With excitement growing to fever heat," Carter recalled in his diary, "I searched the seal impressions on the door for evidence of the identity of the owner, but could find no name. . . . It needed all my self-control to keep from breaking down the doorway and investigating then and there."

Carter loosely repacked the rubble, then sent a telegram to Carnarvon at his Hampshire castle: "At last have made wonderful discovery in the Valley; a magnificent tomb with seals intact; re-covered same for your arrival; congratulations." Three weeks later, the 57-year-old Carnarvon arrived with his daughter, Evelyn Herbert. Carter and his team then dug away four more steps, excitedly uncovering seals that bore the name Tutankhamun. Removing a door, they encountered a passageway packed with rubble. Sifting through flint and limestone chips, they discovered broken jars, vases and pots—"clear evidence of plundering," wrote Carter—and their hearts sank. But at the end of the 30-foot-long passage, they found a second blocked door also bearing Tut's seals. Boring a hole in the upper left corner, Carter poked a candle into the opening as Carnarvon, his daughter and Arthur Callender, an architect and engineer who assisted in the excavations, looked on impatiently. Can you see anything? asked Carnarvon. Momentarily struck dumb with amazement, the archaeologist replied at last. "Wonderful things," he said.

Widening the opening and shining a flashlight into the room, Carter and Carnarvon saw effigies of a king, falcon-headed figures, a golden throne, overturned chariots, a gilded snake, and "gold—everywhere the glint of gold." Carter later recalled that his first impression was of uncovering "the property room of an opera of a vanished civilization."

Carter spent nearly three months photographing and clearing out the antechamber's objects alone. Then in mid-February 1923, after digging out the blocked doorway to the burial chamber, he encountered what appeared to be a solid wall of gold. This proved to be the outermost of four nested gilded wood shrines, an imposing construction—17 feet long, 11 feet wide and 9 feet high, embellished inside with scenes of winged goddesses, pharaohs and written spells—that enclosed Tutankhamun's yellow quartzite sarcophagus.

Slipping through the narrow space between the nested

Tutankhamun likely used this ebony and ivory chair (left) when he was a child. A calcite cosmetic jar (right), also found in his tomb, held the remains of a fatty ointment. "The mystery of his life still eludes us," Howard Carter wrote of the young king, "the shadows move but the dark is never quite dispersed."

shrines and a wall painted with murals welcoming the king into the afterlife, Carter shined his flashlight through an open doorway to the treasury room beyond, guarded by the statue of a recumbent jackal representing Anubis, the god of embalming. Beyond it gleamed a massive gilt shrine, later found to house a calcite chest containing the desiccated remains of Tut's liver, stomach, intestines and lungs. Surrounded by a quartet of goddesses, each three feet tall, the shrine, Carter wrote, was "the most beautiful monument that I have ever seen. . . . so lovely it made one gasp with wonder and admiration."

Grave robbers had in fact broken into the tomb at least twice in ancient times, and made off with jewelry and other small objects from the antechamber, the first room Carter discovered, and a smaller, adjoining annex. They had also penetrated the burial chamber and treasury, but, apparently unable to access the inner shrines protecting Tut's sarcophagus, had taken very little of value. After each occasion, necropolis guards had resealed the tomb. According to calculations based on packing inventories found in the tomb, the thieves made off with about 60 percent of the original jewelry. But more than 200 pieces of jewelry remained, many inside Tut's sarcophagus, inserted into his mummy's wrappings. In addition, hundreds of artifacts—furniture, weapons, clothing, games, food and jars of wine (all for the pharaoh's use in the afterlife)—were left untouched.

Seven weeks after the opening of the burial chamber, Carnarvon died from a mosquito bite that he had infected while shaving. Immediately, sensation-seeking journalists blamed his death on the pharaoh's "curse"—the superstition, spread after Carter's discovery by Marie Corelli, a popular Scottish author, that anyone who disturbed Tut's tomb would suffer an untimely end.

It took another two years and eight months of removing and cataloging objects before the ever-meticulous Carter raised the lid of the third and final coffin (245 pounds of solid gold) inside the sarcophagus and gazed at the gold and lapis lazuli mask atop Tut's mummy. Three weeks later, after cutting away resin-encrusted wrappings from the mask, Carter was able to savor the "beautiful and well-formed features" of the mummy itself. Yet it was not until February 1932, nearly a decade after opening the tomb, that he finally finished photographing and recording all the details of Tut's treasures, a mind-boggling 5,398 items.

Just eight years before Carter's discovery, American lawyer and archaeologist Theodore Davis, who had financed numerous expeditions to the Valley of the Kings, had turned in his shovel. "I fear the Valley is now exhausted," he had declared. Mere feet from where Davis had stopped digging, the dogged Carter, quite literally, struck gold.

KENNETH GARRETT / FROM TUTANKHAMUN AND THE GOLDEN AGE OF THE PHARAOHS, NATIONAL GEOGRAPHIC SOCIETY (WASHINGTON, DC) 2005; ANDREAS F. VOEGELIN / ANTIKENMUSEUM BASEL UND SAMMLUNG LUDWIG / SUPREME COUNCIL OF ANTIQUITIES, CAIRO

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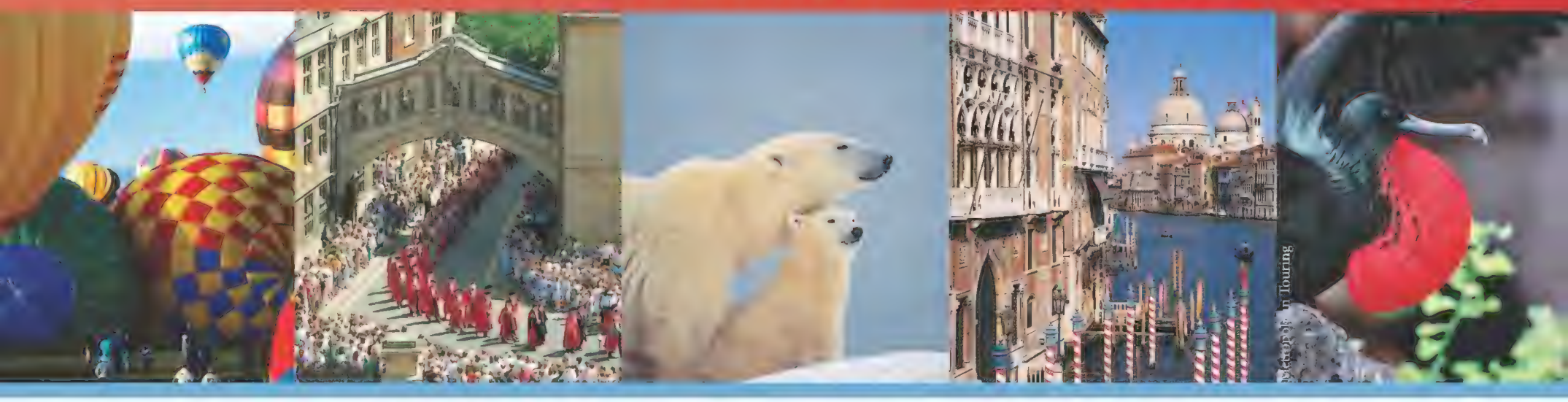

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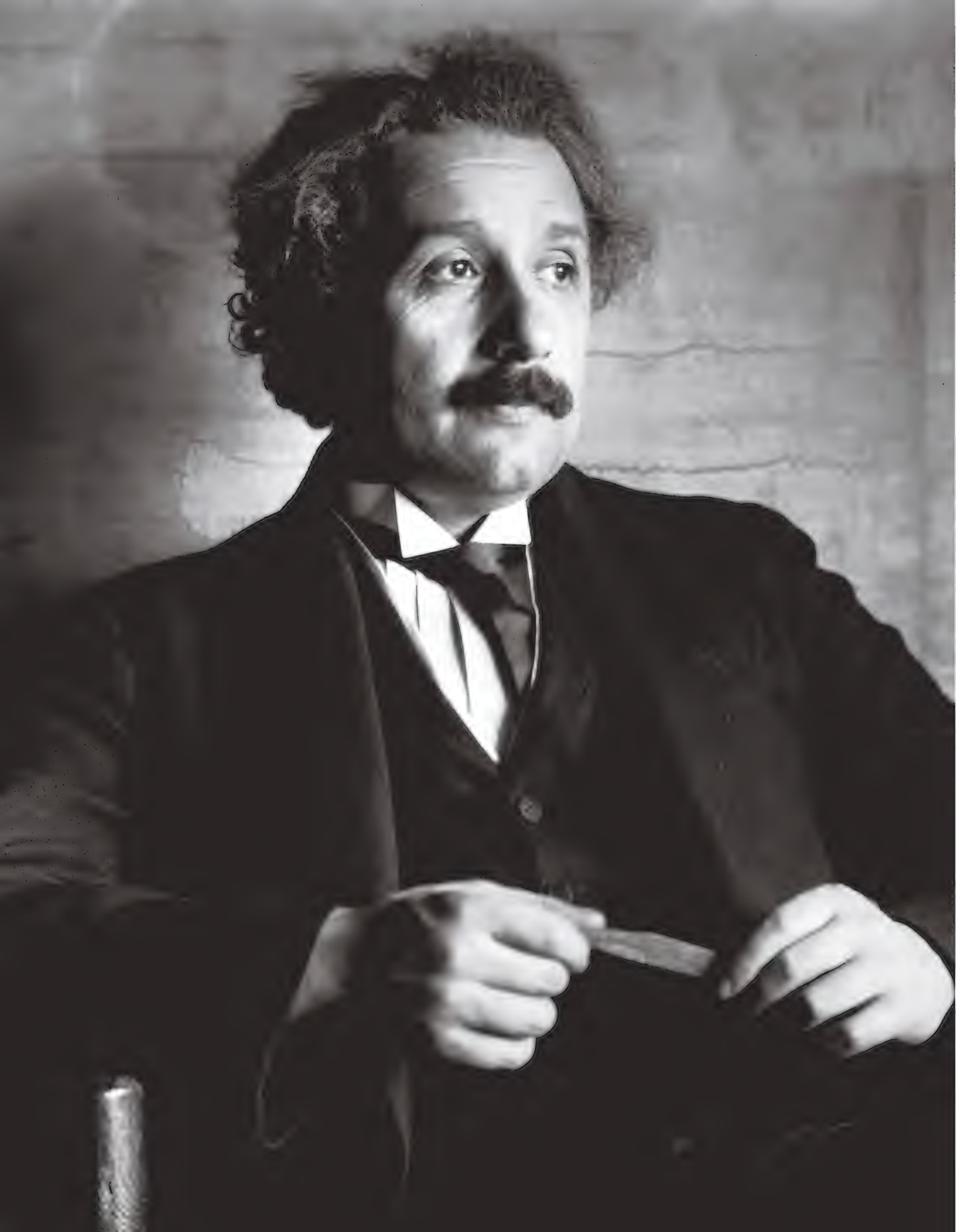


THE YEAR OF ALBERT EINSTEIN

HIS DIZZYING DISCOVERIES IN 1905 WOULD FOREVER CHANGE OUR UNDERSTANDING OF THE UNIVERSE. AMID ALL THE CENTENNIAL HOOPLA, THE TRICK IS TO SEPARATE THE MAN FROM THE MATH

BY RICHARD PANEK

FERDINAND SCHMUTZER / AUSTRIAN NATIONAL LIBRARY / AGENCY ANZENBERGER, VIENNA

OVER FOUR MONTHS, March through June 1905, Albert Einstein produced four papers that revolutionized science. One explained how to measure the size of molecules in a liquid, a second posited how to determine their movement, and a third described how light comes in packets called photons—the foundation of quantum physics and the idea that eventually won him the Nobel Prize. A fourth paper introduced special relativity, leading physicists to reconsider notions of space and time that had sufficed since the dawn of civilization. Then, a few months later, almost as an afterthought, Einstein pointed out in a fifth paper that matter and energy can be interchangeable at the atomic level—specifically, that $E=mc^2$, the scientific basis of nuclear energy and the most famous mathematical equation in history.

No wonder 2005 has been designated worldwide as a celebration of all things Einstein. International physics organizations have proclaimed this centenary as the World Year of Physics, and thousands of scientific and educational institutions have followed their lead. Images of Einstein have become even more common than usual, discussions of his impact a cultural drumbeat. "His name is synonymous with science," says Brian Schwartz, a physicist at the City University of New York Graduate Center. "If you ask kids to show you what a scientist looks like, the first thing they'll draw is wild white hair."

In many ways, Einstein's "miracle year" inaugurated the modern era, with its jumpy, discordant points of view and shocks to established truths. But the time, generally, was one of great cultural and social upheaval. Also in 1905, Sigmund Freud published his essay "Jokes and their Relation to the Unconscious" and an account of one of his first psychoanalyses. Pablo Picasso switched from his Blue Period to his Rose Period. James Joyce completed his first book, *Dubliners*. Still, no one's rethinking of universal assumptions was more profound than Einstein's.

Largely for that reason, Einstein today is more myth than man, and the essence of that myth is that the workings of his mind are beyond the reach not only of most mortals but even of most physicists. As with many myths, there's some truth to it. "I learned general relativity three times," says Spencer Weart, director of the Center for History of Physics at the American Institute of Physics. "It's that difficult, subtle, different."

The 20th century's greatest scientist claimed not to fathom one big mystery: why the public was so fascinated by him.

But there's also a good deal of exaggeration to the myth. Right from the start, long before he was Einstein the Inscrutable, the most prescient of his fellow physicists understood what he'd accomplished and its larger significance. He'd reinvented physics, which is just another way of saying he'd reinvented the way we all—physicists and nonphysicists alike—conceive of our place in the cosmos.

SPECIFICALLY, he'd reinvented relativity.

In a 1632 treatise, Galileo Galilei set forth what would become the classic version of relativity. He invited you, his reader, to imagine yourself on a dock, observing a ship moving at a steady rate. If someone at the top of the ship's mast were to drop a rock, where would it land? At the base of the mast? Or some small distance back, corresponding to the distance that the ship had covered while the rock was falling?

The intuitive answer is some small distance back. The correct answer is the base of the mast. From the point of view of the sailor who dropped the rock, the rock falls

Raised in Munich, where his father, Hermann, ran an electrical business, Albert was 2 when his sister Maja was born and his parents said he would have something to play with (left, Albert, 14, with Maja). "But where are its wheels?" he asked.

EINSTEIN'S NOT ALTOGETHER IMMUTABLE TIMELINE

1879 Born in Ulm, Germany
1900 Graduates from Zurich Polytechnic
1902 Daughter Lieserl born to Mileva Maric
1903 Marries Maric
1904 Son Hans Albert is born
1905 Einstein's "miracle year;" receives Ph.D. from University of Zurich
1910 Son Eduard is born
1914 Moves to Berlin and separates from Mileva
1916 Publishes general theory of relativity
1919 Marries cousin Elsa Einstein; eclipse data prove general relativity
1933 Moves to Princeton, New Jersey
1939 Urges President Roosevelt to develop atomic bomb
1940 Becomes U.S. citizen
1955 Dies of a ruptured aneurysm at age 76
1900
1910
1920
1930
1940
1950

straight down. But for you on the dock, the rock would appear to fall at an angle. Both you and the sailor would have equal claim to being right—the motion of the rock is relative to whoever is observing it.

Einstein, however, had a question. It had bothered him for ten years, from the time he was a 16-year-old student in Aarau, Switzerland, until one fateful evening in May 1905. Walking home from work, Einstein fell into conversation with Michele Besso, a fellow physicist and his best friend at the patent office in Bern, Switzerland, where they were both clerks. Einstein's question, in effect, added a complication to Galileo's imagery: What if the object descending from the top of the mast wasn't a rock but a beam of light?

His choice wasn't arbitrary. Forty years earlier, the Scottish physicist James Clerk Maxwell had demonstrated that the speed of light is constant. It's the same whether you're moving toward the source of light or away from it, or whether it's moving toward or away from you. (What changes isn't the speed of the light waves, but the number of waves that reach you in a certain length of time.) Suppose you go back to the dock and look at Galileo's ship, only now the height of its mast is 186,282 miles, or the distance that light travels in a vacuum in one second. (It's a tall ship.) If the person at the top of the mast sends a light signal straight down while the ship is moving, where will it land? For Einstein as well as Galileo, it lands at the base of the mast. From your point of view on the dock, the base of the mast will have moved out from under the top of the mast during the descent, as it did when the rock was falling. This means that the distance the light has traveled, from your point of view, has lengthened. It's not 186,282 miles. It's more.

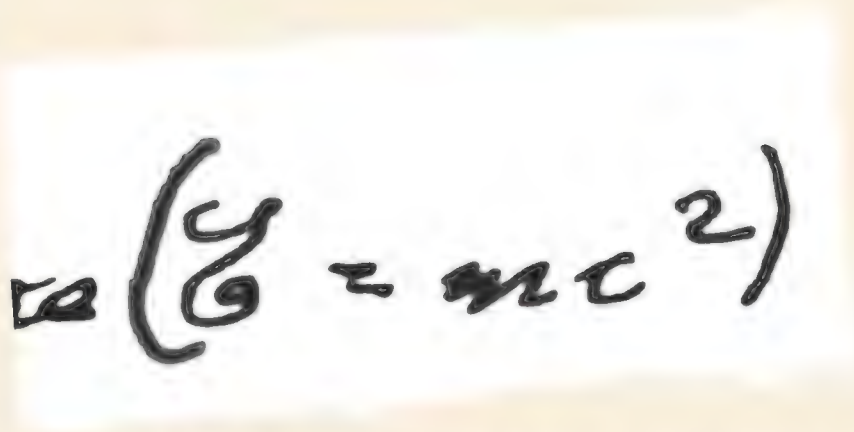
That's where Einstein begins to depart from Galileo. The speed of light is always 186,282 miles per second. Speed is simply distance divided by, or "per," a length of time. In the case of a beam of light, the speed is always 186,282 miles per second, so if you change the distance that the beam of light travels, you also have to change the time.

You have to change the time.

"Thank you!" Einstein greeted Besso the morning after their momentous discussion. "I have completely solved the problem."

According to Einstein's calculations, time itself wasn't constant, an absolute, an immutable part of the universe. Now it was a variable that depended on how you and whatever you're observing are moving in relation to each other. "Every other physicist assumed that there was a universal world clock that kept time," says Schwartz. "Einstein completely removed that idea." From the point of view of the person on the dock, the time it took the light to reach the ship's deck was longer than a second. That means the time on board the ship appeared to be passing more slowly than on the dock. The reverse, Einstein knew, would also have to

RICHARD PANEK is the author of The Invisible Century: Einstein, Freud, and the Search for Hidden Universes.



THE LAST WORD ON ENERGY

It may be the world's most famous equation, but what does $E=mc^2$ actually mean?

Shortly after completing his paper on special relativity, in 1905, Einstein realized his equations applied to more than space and time. From the point of view of an observer standing still relative to an object moving very fast—approaching the speed of light—the object would appear to be gaining mass. And the greater its velocity—in other words the more energy that had been spent in getting it moving—the greater its apparent mass. Specifically, the measure of its energy would be equal to the measure of its mass multiplied by the speed of light squared.

The equation didn't help scientists engineer an atomic bomb, but it does explain why smashing atoms can release mushroom clouds' worth of power. The speed of light, or c, is a big number: 186,282 miles per second. Multiply it by itself, and the result is, well, a really big number: 34,700,983,524. Now multiply that number by even an extraordinarily minute amount of mass, such as what one might find in the nucleus of an atom, and the result is still an extraordinarily tremendous number. And that number is E, energy.

Prompted by two nuclear physicists, Einstein wrote to President Franklin D. Roosevelt on August 2, 1939, that "extremely powerful bombs" of a new type were now "conceivable." Historians tend to think the letter played a "strictly subsidiary role" in the decision of the Allied powers to pursue the nuclear option, says physics historian Spencer Weart. But the fact that Einstein and, indirectly, his equation played any role whatsoever has forever linked a lifelong pacifist and utopian with mankind's ability to destroy itself.

Einstein later realized that his assessment that German scientists would be capable of building an atomic bomb—the opinion that drove him to write to FDR—was mistaken. "If I had known that these fears were groundless," he wrote to a friend late in life, "I would not have taken part in opening that Pandora's box." But open it now was, never to close, as Einstein himself had acknowledged elliptically, almost poetically, back in August 1945, when he first heard the news about Hiroshima. "*Oh, Weh*"—using the German word for pain. "And that's that."

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A NEW VIEW OF GRAVITY

Einstein's vision of a man falling from a roof marked the beginning of a great struggle

Once while Einstein was working on the equations for general relativity, which would take him eight years to complete, he went mountain-climbing with the French-Polish chemist Marie Curie. Seemingly oblivious to the crevasses as well as to her difficulty in understanding his German, Einstein spent much of the time talking about gravitation. "You understand," Einstein said to her, suddenly gripping her arm, "what I need to know is exactly what happens in an elevator when it falls into emptiness."

In Einstein's imagination, the man suspended midway between roof and earth was now inside an elevator. In a certain set of circumstances, the passenger would have no way of knowing whether he was experiencing gravity or upward acceleration. If the elevator were standing on the surface of the earth, the man would feel gravity's force there, which causes falling objects to accelerate at a rate of 32 feet per second squared. But if the elevator were accelerating through deep space at that same rate, he would experience precisely the same downward force.

Einstein imagined a beam of light piercing the elevator. If the elevator were rising relative to the source of light, the beam would enter at a certain height on one side of the elevator and appear to curve on its way to a lower height on the opposite wall. Einstein then imagined that the elevator were stationary on the surface of the earth. Since he postulated that the two circumstances are the same, Einstein concluded that the same effect would have to hold true for both. In other words, gravity must bend light.

He wouldn't have the math to support this idea until 1915, and he wouldn't have the proof until the eclipse expeditions of 1919. But by then he was so confident of his calculations that when a student asked what he would have done if he'd heard the eclipse observations hadn't validated his math, Einstein told her, "Then I would have been sorry for the dear Lord. The theory *is* correct."

Marie Curie (with Einstein circa 1929) was a muse for his relativity.

During his first trip to the United States (en route with second wife Elsa Einstein in 1921), Einstein mixed physics lectures with fundraising on behalf of Hebrew University in Jerusalem.

be true. From the sailor's point of view, the dock would be moving, and therefore a beam of light sent down from a tall post on land would appear to him to travel a bit farther than it would to you on the dock. To the sailor, the time onshore would appear to be passing more slowly. And there we have it: a new principle of relativity.

"Henceforth, space by itself, and time by itself, are doomed to fade away into mere shadows," the German mathematician Hermann Minkowski declared in 1908.

Other physicists had done calculations that showed a similar difference in measurement of time between two observers, but they always added some version of "but not really." For them, a difference in time might be in the math, but it wasn't in the world. Einstein, however, said there is no "really." There is only what you on the dock can measure about time on board the moving ship and what the sailor can measure about time on board the moving ship. The difference between the two is in the math, and the math *is* the world. Einstein's insight was that because these perceptions are all that we can ever know, they are also, in terms of taking the measure of the universe, all that matter.

THIS WAS PRETTY HEADY STUFF for a 26-year-old clerk who only a couple of weeks earlier had submitted his doctoral thesis to the University of Zurich. Einstein would keep his day job at the patent office until 1909, but his obscurity was over, at least among physicists. Within a year of completing his relativity paper, his ideas were being debated by some of the most prominent scientists in Germany. In 1908 physicist Johann Jakob Laub traveled from Würzburg to Bern to study with Einstein, exclaiming that to find the great man still laboring in a patent office was one of history's "bad jokes." But Einstein wasn't complaining. His "handsome" pay, as he wrote a friend, was sufficient to support a wife and 4-year-old son,

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Hans Albert, and his schedule left him "eight hours of fun in the day, and then there is also Sunday." Even on the job, he found plenty of time to daydream.

During one such daydream, Einstein experienced what he would later call "the most fortunate thought of my life."

He knew that his 1905 special relativity theory applied only to the relationship between a body at rest and a body moving at a constant velocity. What about bodies moving at changing velocities? In the fall of 1907, he saw a vision in his mind's eye not unlike a beam of light descending from a mast: a man falling off a roof.

What's the difference? Unlike the beam of light, which moves at a constant velocity, the falling man would be accelerating. But in another sense, he would also be at rest. Throughout the universe, every scrap of matter would be exerting its exquisitely predictable influence on the man, through gravity. This was Einstein's key insight—that acceleration and gravitation are two ways of describing the same force. Just as someone on board Galileo's ship would have as much right to think of the dock leaving the ship as the ship leaving the dock, so the man in free fall from the roof would have as much right to think of himself being at rest while the earth hurtles toward him. And there we have it: another principle of relativity, called general relativity.

"Einstein always took what everyone else thought to be two completely different scenarios of nature and saw them as equivalent," says Gerald Holton of Harvard, a leading Einstein scholar. Space and time, energy and mass, and acceleration and gravitation: as Holton says, "Einstein was always confronting the question, Why should there be two different phenomena with two different theories to explain them when they look to me like one phenomenon?"

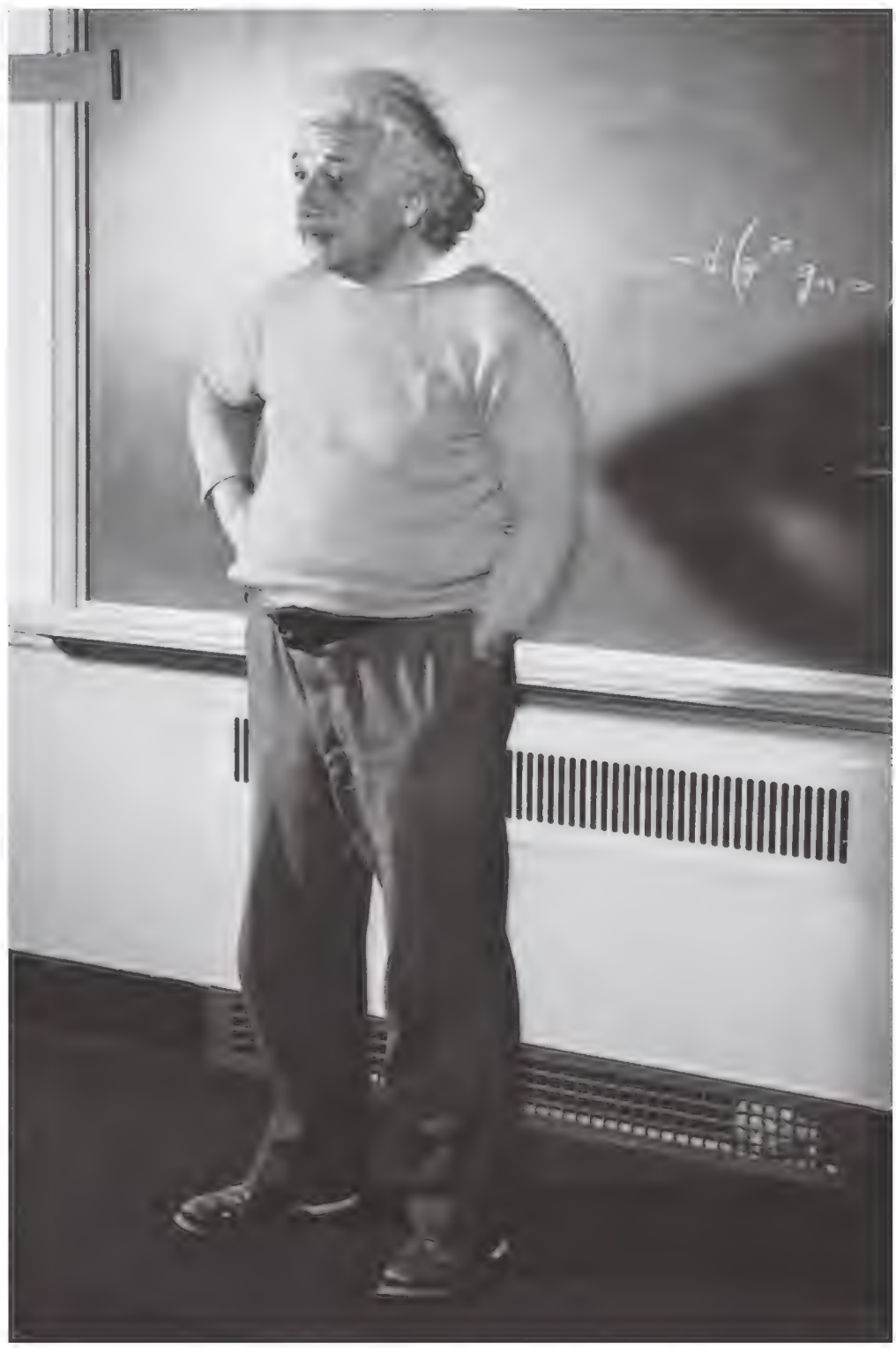
After his 1907 vision, however, another eight years would pass before Einstein worked out the equations to support it. (See sidebar, p. 112.) Einstein told friends that when he finally figured out the math to demonstrate general relativity in 1915, something burst inside him. He could feel his heart beating erratically, and the palpitations didn't stop for days. He later wrote a friend, "I was beyond myself with excitement."

BY THEN, Einstein was a professor at the University of Berlin, and the Great War was raging across the Continent. For word of Einstein's achievement to reach the wider world of physicists, it was going to have to travel across enemy lines. Einstein carried his writings on general relativity to the Netherlands, and from there a physicist friend forwarded them across the North Sea to England, where they eventually reached Arthur Eddington, perhaps the only astronomer in the world with the political clout and scientific prominence sufficient to mobilize wartime resources and to put general relativity to the test.

Einstein had theorized that a solar eclipse offered a rare opportunity to observe gravity's effect on light. As the daytime sky darkened, stars would become visible, and if indeed the sun's gravity pulled on the passing light, then those stars near the edge of the sun would appear to be out of position by a degree his equations predicted precisely. Eddington rallied his nation's scientific troops, and Great Britain's Astronomer Royal, Sir Frank Dyson, petitioned his war-depleted government to send two expeditions to observe the total eclipse on May 29, 1919—one to Sobral, Brazil, the other to Príncipe, an island off the west coast of Africa.

In late September, Einstein got a telegram saying that the eclipse results matched his predictions. In October, he ac-

"I do know that kind fate allowed me to find a couple of nice ideas after many years of feverish labor," Einstein (at the Institute for Advanced Study in Princeton in 1940) once wrote to a fellow physicist.



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cepted the congratulations of the most prominent physicists on the Continent at a meeting in Amsterdam. Then he went home to Berlin. As far as he knew, he'd gotten his due.

"REVOLUTION IN SCIENCE," the November 7 *Times* of London trumpeted. "New Theory of the Universe. Newtonian Ideas Overthrown." The preceding day, Dyson had read aloud the eclipse results at a rare joint session of the Royal Society and the Royal Astronomical Society. The Royal Society president and the discoverer of the electron, J. J. Thomson, called Einstein's theory, in a quote that raced around the world, "one of the most momentous, if not the most momentous, pronouncements of human thought."

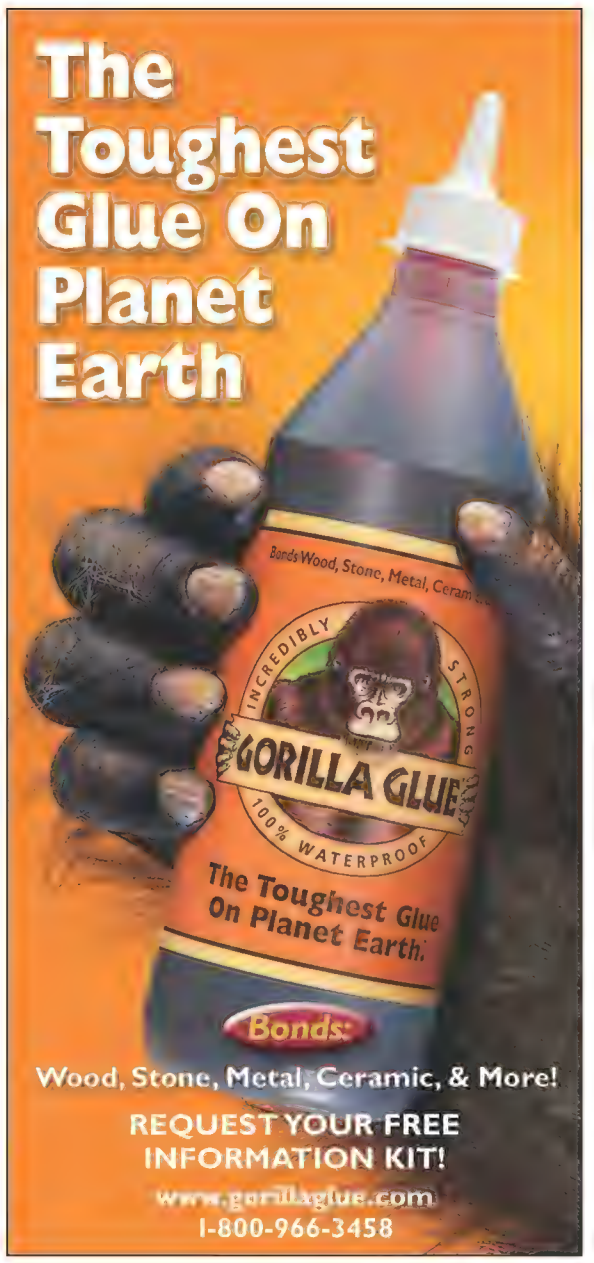
Only then, 14 years after Einstein's miracle year, did the range of Einstein's accomplishments begin to become common knowledge. Because the public learned about special relativity and general relativity at the same time, says Weart, the cult of Einstein coalesced quickly. "And then came quantum theory, and people went back and said, 'Oh, yeah, Einstein did that, too.'"

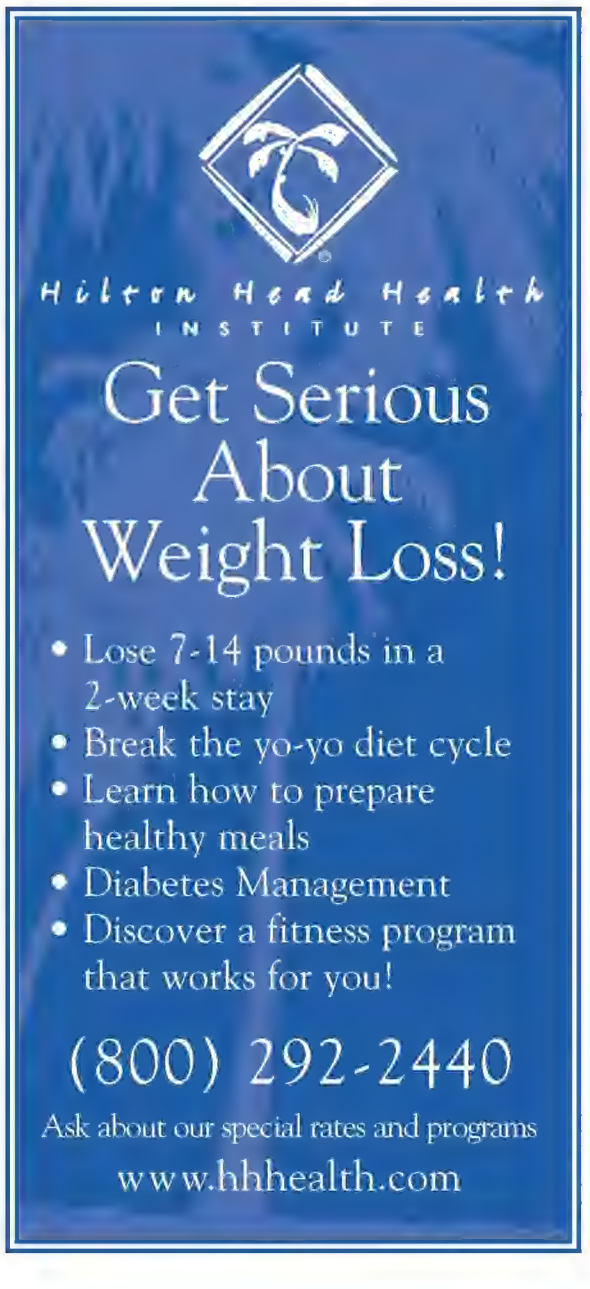
An accurate count of articles about Einstein around the world in 1919—that first year of fame—is probably impossible; an essay contest sponsored by *Scientific American* for the best explanation of relativity in layperson's terms attracted entries from more than 20 countries. "I have been so swamped with questions, invitations, challenges," Einstein wrote in a letter during this period, "that I dream that I am burning in Hell and that the postman is the Devil eternally roaring at me, throwing new bundles of letters at my head because I have not yet answered the old ones."

And all this celebrity, British astronomer W.J.S. Lockyer remarked, was for discoveries that "do not personally concern ordinary human beings; only astronomers are affected." The depth of the response could be due only to the historical moment—the aftermath of the Great War. "Here was something which captured the imagination," wrote Leopold Infeld, a Polish physicist and future collaborator of Einstein's: "human eyes looking from an earth covered with graves and blood to the heavens covered with the stars."

To many, Einstein became a symbol of postwar rapprochement and a return to reason. As Eddington wrote to him less than a month after the eclipse announcement, "For scientific relations between England and Germany this is the best thing that could have happened." Even today, that interpretation continues to resonate. "During that war when much of humanity devoted itself to senseless destruction," Holton has said, Einstein "revealed the outlines of the grand construction of the universe. That must count as one of the most moral acts of that time."

But some critics of relativity argued that Einstein was merely one more anarchist fueling the funeral pyres of civi-

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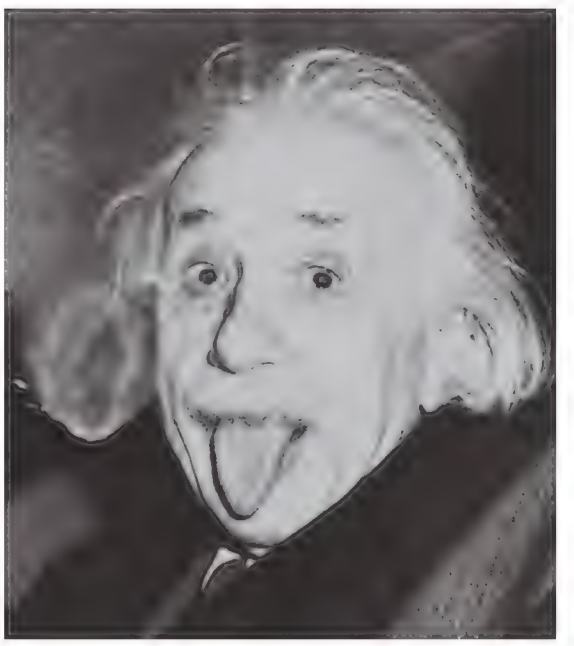
lization. A professor of celestial mechanics at Columbia University worried in the *New York Times* in November 1919 that the impulse to "throw aside the well-tested theories upon which have been built the entire structure of modern scientific and mechanical development" was of a piece with "the war, the strikes, the Bolshevist uprisings."

Einstein's own political leanings further complicated people's responses to his work. A visceral, lifelong anti-authoritarian, he had renounced his German citizenship at age 16 rather than subject himself to mandatory military service. Now, in the nascent Weimar Republic, Einstein, a Jew, found himself portrayed as a villain by swastika-sporting German nationalists and as a hero by internationalists. "This world is a curious madhouse," Einstein wrote a friend. "At present every coachman and every waiter argues about whether the relativity theory is correct. A person's conviction on this point depends on the political party he belongs to." The "arguments" soon descended into death threats, and Einstein briefly fled Germany for a speaking tour of Japan. After Hitler rose to power in 1933, Einstein abandoned Germany for good. He accepted an appointment to the Institute for Advanced Study in Princeton, where he lived in a modest house on Mercer Street until his death from a ruptured abdominal aneurysm at age 76 in April 1955.

Throughout his public years, Einstein embodied contradictions. A pacifist, he would advocate the construction of the atomic bomb. (See sidebar, p. 111.) He argued for a world without borders, and campaigned for the establishment of the state of Israel—so much so that in 1952 he was invited to be its president. He was a genius, puttering absent-mindedly around his house in Princeton, and he was a joker, sticking out his tongue for a photographer. But it wasn't simply these contradictions that distinguished him. It was their scale. They were all larger than life, and so therefore, the thinking went, must he be, too.

But he wasn't, as he well knew. His first marriage had ended in divorce, a second, to a cousin, in her death, nearly two decades before his. He fathered one illegitimate daughter, who is thought to have been given up for adoption and is lost to history, and two sons, Hans Albert and Eduard. One of them, Eduard, suffered from schizophrenia. Hans Albert taught engineering at UC Berkeley. Yet somehow Einstein *père* became a myth among men.



"Dear Posterity," Einstein (in 1951) once wrote. "If you have not become more just, more peaceful, and in general more sensible . . . then may the Devil take you!"

It was a fate Einstein hated. "I feel," he wrote a friend in 1920, "like a graven image"—as if there were something blasphemous in how his idolaters even then were beginning to fashion him. And maybe there was. Once the Nazis were defeated, Einstein would become not all things to all people but one thing to all people: a saint.

The halo of white hair helped. In 1919, when the world first made Einstein's acquaintance, his 40-year-old, slightly cocky visage only hinted at the caricature to come. But in time his hair flew, like a mind untethered, while the bags under his eyes deepened, as if from the burden of looking too hard and seeing too much. And as for those eyes—well, when Steven Spielberg was designing the title character of *E.T. the Extra-Terrestrial*, and he wanted his alien ambassador of good will to have eyes that were moist like a wise old man's yet twinkling with childlike wonder, he knew whose to use.

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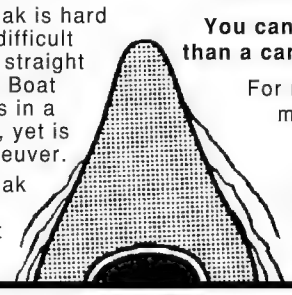
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Long before the public beatified Einstein, his fellow physicists had begun to question his infallibility. When the Russian mathematician Aleksandr Friedmann in 1922 noted that, according to his calculations using Einstein's equations, the universe could be expanding or contracting, Einstein wrote a brief rebuttal saying Friedmann's math was mistaken. A year later Einstein acknowledged that the error had in fact been his, yet he remained unrepentant. Only after the American astronomer Edwin Hubble's 1929 discovery that other galaxies are receding from our own—that the universe is indeed expanding—did Einstein relent. He'd committed his "greatest blunder," he sighed.

Stubbornness would also dominate his attitude toward quantum mechanics, even though the field was partly an outgrowth of Einstein's 1905 paper on photons. Einstein frequently and famously objected to the central tenet of quantum theory—that the subatomic world operates according to statistical probabilities rather than cause-and-effect certainties. "God does not play dice with the universe," he often declared, and to the increasing exasperation of colleagues, he spent the last three decades of his life trying—without success—to find a grand unified theory that would banish such uncertainty.

"Einstein was single-minded, and you can see the good and the bad in that," says Michael S. Turner, a cosmologist at the University of Chicago and a director for mathematical and physical sciences at the National Science Foundation. "He was single-minded in reconciling general relativity with Newton's theory of gravity, and he hit a home run. But he was also single-minded about finding a unified field theory, and from 1920 on, his career was that of a mere mortal." Over the decades, experiments have repeatedly supported both the relativistic and the quantum interpretations of the cosmos. "Space is flexible," Turner says. "Time warps. And God plays dice."

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bedded within Einstein's equations—the big bang theory of the creation of the universe, a conclusion that seems inevitable if one "runs the film" of Hubble's expanding universe backward. And there have been other startling ramifications of relativity theory, such as black holes, which can be created by collapsed stars with masses so great that their gravitational force swallows everything in their vicinity, including light. As Weart says, quoting a maxim among physicists, "The general theory of relativity just dropped in 50 years ahead of its time."

Scientists are still asking questions that Einstein made possible: What powered the big bang? What happens to space, time and matter at the edge of a black hole? What mysterious energy is causing the acceleration of the universe's expansion? "This is really the golden age for Einstein's theory, quite apart from the centenary," says Clifford M. Will, a physicist at Washington University in St. Louis and the author of *Was Einstein Right?*

For his part, Einstein never quite knew what hit him. "I never understood why the theory of relativity with its concepts and problems so far removed from practical life should for so long have met with a lively, or indeed passionate, resonance among broad circles of the public," he wrote in 1942, at age 63. "What could have produced this great and persistent psychological effect? I never yet heard a truly convincing answer to this question."

Yet when Einstein attended the Hollywood première of *City Lights* in 1931, the movie's star and director, Charlie Chaplin, offered him an explanation: "They cheer me because they all understand me, and they cheer you because no one understands you." Maybe Einstein achieved his peculiar brand of immortality not in spite of his inscrutability but because of it. Social scientist Bernard H. Gustin has suggested that an Einstein assumes godlike status because he is "thought to come into contact with what is essential in the universe." Holton recently elaborated on this comment: "I believe

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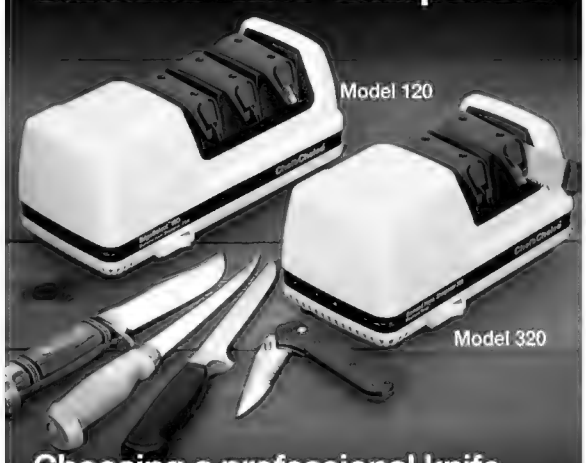

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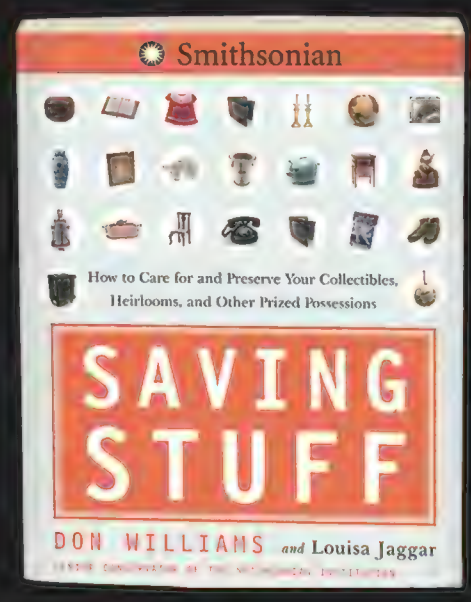
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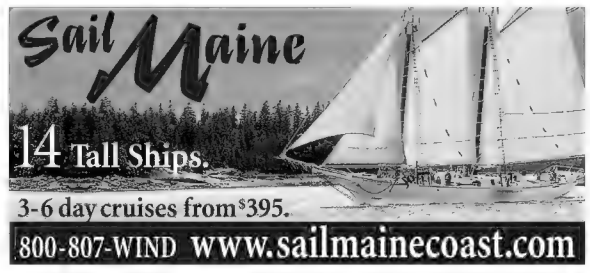

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Charlie Chaplin (with Einstein at the Hollywood première of *City Lights* in 1931) said the physicist was adored because he was incomprehensible.

this is precisely why so many who knew little about Einstein's scientific writing flocked to catch a glimpse of him, and to this day feel somehow uplifted by contemplating his iconic image."

The halo has helped maintain the myth, keeping Einstein a presence on magazine covers and newspaper front pages, on posters and postcards, coffee mugs, baseball caps, T-shirts, refrigerator magnets and, based on a Google search, 23,600 Internet sites. But what we're celebrating this year is more than a myth. In reinventing relativity, Einstein also reinvented nothing less than the way we see the universe. For thousands of years, astronomers and mathematicians had studied the motions of bodies in the night sky, then searched for equations to match them. Einstein did the reverse. He started with idle musings and scratches on paper and wound up pointing toward phenomena previously unimaginable and still unfathomable. "The general theory of relativity is one man's idea of what the universe ought to be like," says Einstein scholar Arthur I. Miller of University College, London. "And that's pretty much what it turned out to be." It's this legacy of Einstein's that the World Year of Physics is commemorating, this lasting contribution to the modern era: the triumph of mind over matter.

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GLYPH DWELLER

ARCHAEOLOGIST ALANAH WOODY'S INFECTIOUS ENTHUSIASM FOR NEVADA'S ROCK ART KNOWS NO BOUNDS **BY CHRISTOPHER HALL**

ALANAH WOODY doesn't wear a fedora or crack a bullwhip, but her fans will tell you that the 5-foot-3 archaeologist is to the rock art of Nevada what Indiana Jones is to the Holy Grail. Like her fictional counterpart, she has had gigs in academia, teaching anthropology and archaeology at the University of Nevada at Reno and elsewhere. She also manages the anthropology collections at the Nevada State Museum in Carson City. But it's her work as co-founder and executive director of the Nevada Rock Art Foundation that has mobilized a small army of volunteers to educate the public, monitor sites and painstakingly record the state's vast collection of rock art, boulder by boulder.

"I am a rock art evangelist," says Woody, 49. "Give me a soapbox and I'll tell the world. Better yet, give me people who think rock art is nothing more than a bunch of old graffiti on a boulder or cave wall. Let me take them out into the desert to see 10,000-year-old petroglyphs, and I guarantee they'll begin to feel a connection with the people who lived here long before we came along with our cars and cellphones."

Whether pictographs (painted images) or petroglyphs (engraved images), rock art is found throughout the world. The oldest known examples date back 35,000 years, though the concentrations found in the American West are estimated to be quite a bit younger. Scattered across vast and arid lands that seem empty until you take a closer look, Nevada's rock art is hidden and elusive. Only a third of the state's 1,500 known sites have been adequately recorded, and no one is sure how many lie undiscovered. Sites range from a couple of squiggly lines on a boulder to Lagomarsino, an 80-acre treasure house of nearly 10,000 distinct groups of petroglyphs worthy, says Woody, "of world heritage status."

"The art is wearing away," says Woody (at Nevada's Grimes Point). "Eventually it will be gone."

"Nevada may be the last best place for rock art," says archaeologist David Hurst Thomas of the American Museum of Natural History in New York City. "And I'm amazed at how Alanah Woody has been able to tap public interest in it in a way that nobody in the professional archaeology community could do before."

Although there are some images of humans and animals, most early Nevada rock art "is abstract, and made by hunter-gatherers," says Woody. "Some people are reluctant to call it art, but that's only because they have a limited view of art and its function. The images are symbolic, and even though archaeologists can't interpret most of them, they still had meaning for the migratory people who once lived here." The images may have functioned as territorial markers, as ways of telling stories and documenting events, or as powerful symbols intended to lure animals to waiting hunters. "We simply haven't recorded enough rock art to figure it out," says Woody.

Born in California's Central Valley to a hard-rock miner father and a homemaker mother, Woody and her family

MARK RICHARDS

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moved frequently for her father's work on water tunnels and big construction projects. She traces her interest in other cultures to a stint in Pakistan, from ages 5 till 13. After high school and some college in Connecticut, she got married and had a son, Christopher, who is now a college sophomore. She came to Nevada, she says, "for the same reason a lot of people do—to get a divorce. And being a single mom, I figured I better get my act together. So I enrolled at the University of Nevada at Reno and took an introductory anthropology course. It was an epiphany. I won't say I heard voices, but I knew this was what I wanted to do." She received her doctorate in 2000 from the University of Southampton in England and helped create the Nevada Rock Art Foundation a year later. One of the organization's missions is to teach volunteers how to use photography, scale drawings and GPS data to document rock art sites. "Out in the field, she'll boss you around, but always with humor and affection," says Cheryl Bennett, a volunteer for two years. "And she's always open to suggestions."

Some archaeologists still think that keeping sites secret offers the best way to protect them from increasing vandalism—everything from bullet holes and graffiti to outright theft—and from the damage that occurs when people touch, climb or walk on them. But Woody says that doesn't work. "Word gets out and then what do you have?" she asks. "Rock art that's vulnerable. While I'm not about to tell the public about all the secret sites I know, I think it's vital that we have places where people can go to see rock art in the landscape, not in a museum, and learn about it. If people learn about rock art, they'll respect it."

Not all threats are man-made—nature also conspires against it through weather, erosion and spalling (the flaking of rock layers). "The art is wearing away," says Woody, "and eventually it will all be gone. Indian friends ask why I'm so intent on making a record of it when it's only natural for it to disappear over time. I tell them that it may help us understand what the art means. Also,

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MARK RICHARDS

This sandstone petroglyph from southern Nevada could be up to 5,000 years old.

it's hard to prosecute vandals unless the site has been documented."

On a warm, overcast Saturday, I tag along as Woody leads a tour to a petroglyph site about a 75-minute drive from Carson City. The site, Grimes Point, consists of hundreds of basalt boulders scattered around a slope that was once the beach of a late ice age lake. "Imagine a family group hanging out next to the lake," she says. "Maybe a few times a year they get together with other groups to make these images."

At first we strain to pick out anything from surrounding rock of a similarly dark color. But soon our eyes adjust, and we see hundreds of the man-made pockmarks known as cupules on the tops and sides of boulders, and abstract line drawings of every conceivable shape—spirals, grids, zigzags, squiggles, circles, crescents.

"Rock art is the perfect hook to get people thinking about whether and how we're all so different," Woody tells me on the drive back to Carson City. "Only humans do art, and people respond to rock art in emotional ways. It connects you directly with those who came before, and you realize you have something in common with folks who lived here 10,000 years ago. In that way it can broaden how we think about others. That's the power of this art, and that's why we need to protect it."

San Francisco-based author CHRISTOPHER HALL, a rock art fan since age 10, wrote about anchovies in the May issue.

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August 31
LA TOMATINA
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Sept

September 2 - 5
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Oct

October 7 - 23
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LUCKY MAN

A STROKE OF ASTONISHING GOOD FORTUNE THAT EVEN THE AUTHOR'S SKEPTICAL FATHER MIGHT EMBRACE **BY DENIS COLLINS**

My Irish-born father was quick with a story, unselfish with his tears and never bashful about singing an answer to the musical question "Who Threw the Overalls in Mistress Murphy's Chowder?" But by one signature measure, the Celtic stereotype fit him no better than a Dublin suit. ("Long in the arms and tight across the shoulders," he liked to complain.) When the subject turned to luck, he was a stone sober skeptic. "If the Irish are so lucky, there wouldn't be so many of us living everywhere else," he told me with rare solemnity after I let my older sisters dress me as a leprechaun for my first Halloween. "You're better off trusting to hard work."

So instead of luxuriating in the luck that was forever being assured us by aunts and uncles whose brogues over their decades in America grew no thinner than the aforementioned soup, my five siblings and I were nightly harnessed to the *Readers Digest*'s vocabulary column, preparing like prizefighters for the year-round campaign of spelling bees.

In letters to my father after I left home, I would often describe some example of great luck—the lost wedding ring recovered from the stomach of a shark, a chance reunion of brothers separated by 50 years and two world wars. He would write back that *someone* had to win the lottery, and, to be sure, a fellow might survive the fall from Damnation Cliff, but wasn't he unlucky to stumble there in the first place?

The only time he stopped trying to refute me was when I became a sportswriter, and I regaled him with tales of luck-crazed stars. He loved the games and especially the athletes, who carried the hopes of cities on their backs like the heroes of antiquity. Did he know that one of Jim Palmer's superstitions (not luck, but a bribe to attain it) was to eat pancakes for breakfast every day that he pitched for the Baltimore Orioles? He didn't, but was Mr. Palmer as nice a man as he appeared on television? And if Boston Red Sox third baseman Wade Boggs ate chicken for lunch each day of the season, who was my father to scoff? He just wanted to know if something of the man's greatness could be seen in his eyes.

It has been 25 years since my father died, and it has taken that long for me to find a lucky story I believe he might have embraced. It began one Monday last December when my friend Hamilton Loeb, who is 53, was talking on the phone at home and fell to the floor. His heart had stopped in midsentence. No apparent luck in that, except for the presence of his 17-year-old son, Max, who was home only because he'd been suspended from school for some mild shenanigan. Max, like all the students at his school, had been taught CPR, and set to work reviving his father until the ambulance arrived.

What stopped Ham's heart was a viral infection, in his left ventricle, and a stubborn siege it was, causing his heart to quit four more times before doctors could stabilize it. They were not optimistic about Ham's chances, though they said he was more likely to survive than to recover full brain function. In what appeared to Ham's friends and family as a desperate measure, the doctors put him in a virtual deep freeze, lowering his body temperature more than ten degrees for 24 hours. That new treatment, which can limit damage to the heart and brain after such an injury, has been described as the equivalent of rebooting a computer.

When he finally woke, tubes running into and out of his body, the first thing he saw on the television above his bed was a scene of devastation caused by a tsunami. Where is that? he asked his doctor. "Thailand." Where in Thailand? "Phuket." The footage showed a beach where Ham and his family would have been sunning themselves at the very moment that the tsunami struck—the hotel was booked, the airline tickets at his home in a drawer—if not for his heart failure. "You are a lucky guy," the doctor told him.

I asked Ham how the experience had changed him. "It softens you," he said. "Two or three times a day this window opens up and I feel so emotionally deep. The other day I was in New York at Grand Central Station, riding a rickety escalator. I looked down at the crowds of people and thought, 'Isn't it wonderful?'"

My father would have appreciated Ham's story, and I'm nearly certain this was a species of luck my father could endorse—a gift not given but earned, by 24 hours in a deep freeze, by his family's heroic action. I'll be sure to put all of it in my next letter to him.

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